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DECEMBER 1927

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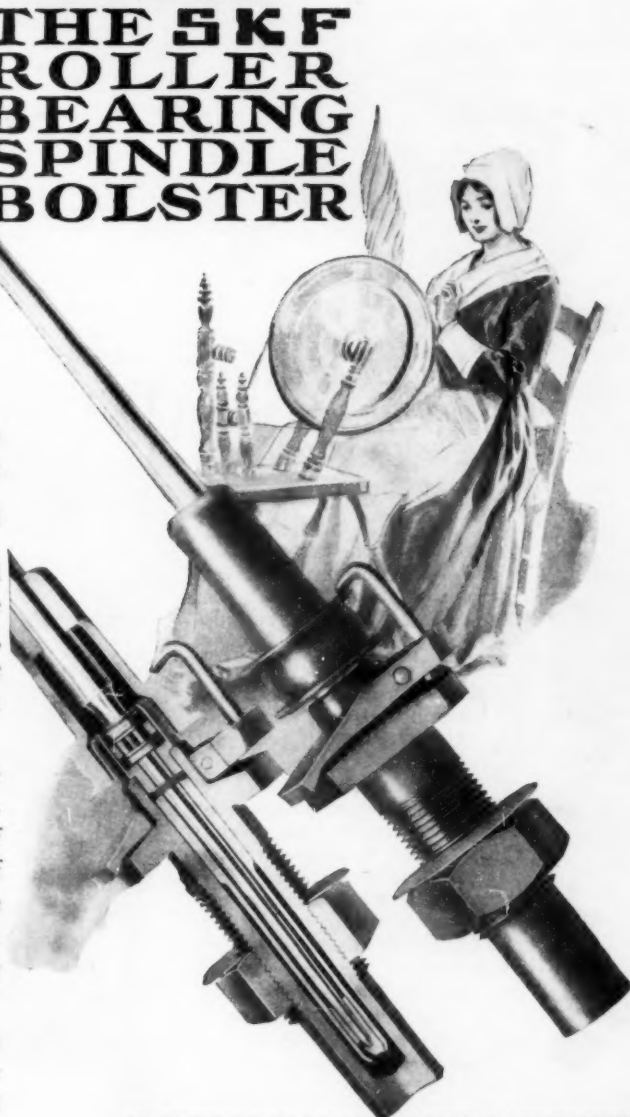
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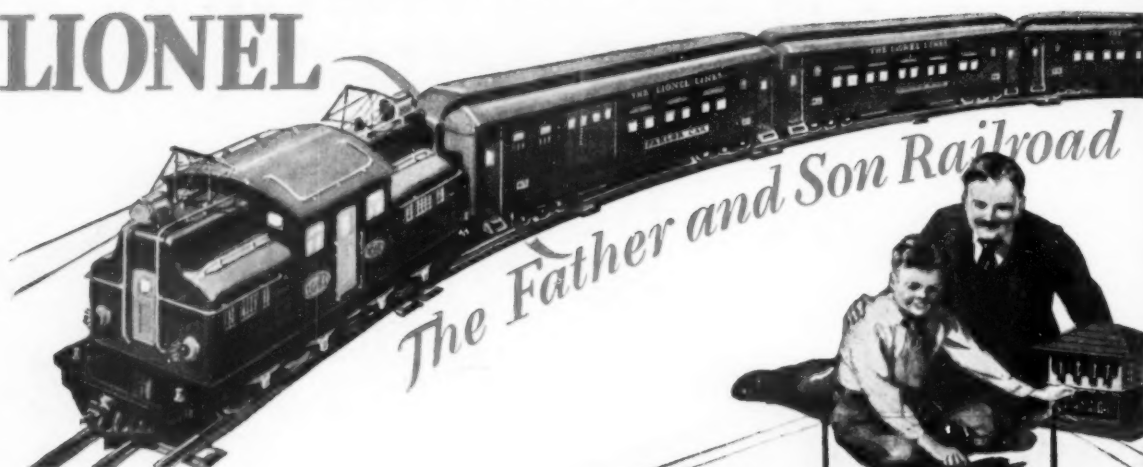


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1936

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SCIENTIFIC AMERICAN

December 1927

Edited by ORSON D. MUNN

Eighty-third Year

Ultra-Violet

MOST people now understand the health value of the ultra-violet (U-V) ray. There are two sources of this ray for treatment—special lamps and the sun. The lamps should be used by specialists, is the pronouncement of the Council on Physical Therapy of the American Medical Association. The sun is different, and within limitations understood by nearly everyone, can seldom do harm. This is because the short wavelengths emitted by lamps, injurious unless employed with understanding, are all safely filtered out of the sunlight by the atmosphere.

The best way to get the U-V of sunlight is to get out of doors into the sunshine—although there is comparatively little U-V in it in winter, especially in smoky cities, except at midday.

Just now the public is becoming interested in various glass substitutes which, unlike common glass, will permit the vital range of the U-V wavelengths to enter the home. Most of these substitutes do let in much of the vital portion of the total U-V, but, as might have been expected, imitations sold under plausible but utterly misleading advertising have recently been put on the market. Here is the nubbin of the argument: These imitations do admit the U-V, but it is not the vital range of the U-V, but the range lying on the spectrum between the vital range and visible light.

Before investing, investigate.

Mississippi

DOES the Mississippi River flow uphill?

This question, with which one bright boy in nearly every geography class tries to stump the teacher, has been asked so often of the Geological Survey of the Department of the Interior, that its Director, G. O. Smith, has issued an official, formal explanation.

"The question which arises so frequently is based on the idea that 'up' is away from the center of the earth and 'down' is towards it," he says. "If these were the only meanings of the words, then it might be said that the Mississippi River flows uphill, for the polar radius of the earth is over 13 miles shorter than the equatorial radius and as the Mississippi River extends over 18 degrees of latitude, its proper proportion of this difference amounts to more than four miles, the river's source being much nearer the center of the earth than its mouth.

"Motion 'up' and 'down,' properly defined, refers to movements against the attraction of gravity or to those acting with it. Water acted upon by gravity alone flows downhill and the Mississippi River, which rises at a point about 1500 feet above the level of the sea, is not an exception to the rule."

Babies

EVER since King Solomon made his decision in the famous case of Wife 176 versus Wife 293, the question of

identifying children with their true parents has been arising. Hospitals have done the best they can, sometimes marking the infant with a silver nitrate pencil, sometimes by footprints or fingerprints, sometimes by bead necklaces spelling out the infant's name. None of these methods, however, is fool proof, no matter how quickly the identifying mark is affixed. Nurses and doctors are but human, and it is human to err.

"This is not my baby!" cries a mother in a hospital when a little bundle of red humanity is brought to her. Records are shown to her; they bear erasures, and she is unconvinced. She cannot prove the child is not hers, the hospital cannot prove it is. Here is a problem for the scientists, if ever there was one. But the scientists throw up their hands; establishing parentage with certainty is something science

CONTENTS

DECEMBER 1927

Lightning Prevention—By Colonel E. H. Wilcox	489
Pre-Sumerian Man—By L. H. Dudley Buxton, M. A., F. S. A.	493
Our Point of View—Editorials	496
Life-saving Airplanes—By S. R. Winters	497
The Giant of Broadcasting—By Orrin E. Dunlap	500
Great Britain's Mechanised Army	503
How Nature Conquers—By H. J. Lutz	504
The Stars of the Manger—By Henry Norris Russell, Ph.D.	506
From the Scrap-book of Science—Camera Shots of Scientific Events	508
Water—The Modern Alladin—By Charles F. A. Mann	510
Successful Inventors—XII—By Milton Wright	513
The "Movie" Theater Up-to-date	516
Scandinavian Six-meter Yacht Supremacy	518
The New Modern Foundry Arrives	519
The Month In Medical Science—By Morris Fishbein, M. D.	520
Which Foot Supports a Golfer's Weight?—By C. Bond Lloyd	522
Learning Language By Its Feel—By Robert H. Gaul, Ph.D.	524
The Post-war Navies—By J. Bernard Walker	526
Miracles Made to Order	529
"Old Ironsides" in Dry Dock	530
Do Insects Feel Pain?—By Harold Bastin	531
Inventions New and Interesting	532
Household Inventions	534

DEPARTMENTS

The SCIENTIFIC AMERICAN Digest	535
Learning to Use Our Wings	539
Industries From Atoms	541
Applied Science for the Amateur	543
Strays From the Ether—Radio Notes	546
In the Editor's Mail—Where Reader Meets Reader	554
The Heavens in December	558
Commercial Property News	569
Patents Recently Issued	569
Index of Volume 137	574

has not yet learned to do. Here is a gap in our knowledge of the ways of nature. It is a gap that should be closed, and who can say that the closing of it will not add more to the peace of mind of our women-folk than all the airplanes that ever could wing their way across the Atlantic?

Cover

ON page 503 of this issue will be found a collection of interesting photographs of the latest types of battle tanks used by the British army. For our cover illustration we have used a painting of one of these tanks equipped with radio apparatus for communication with airplanes and with other tanks. This use of wireless is of particular advantage for the transmission of orders and for obtaining directions for use by the pilots of the tanks.

Bearing Life is Car Life

Right down where the power of cars and trucks is turned into miles, speed, profit and pleasure, the bearings are at work. Right where bumps, hills and curves try to do their worst to the chassis, only the best bearings can prevent it.

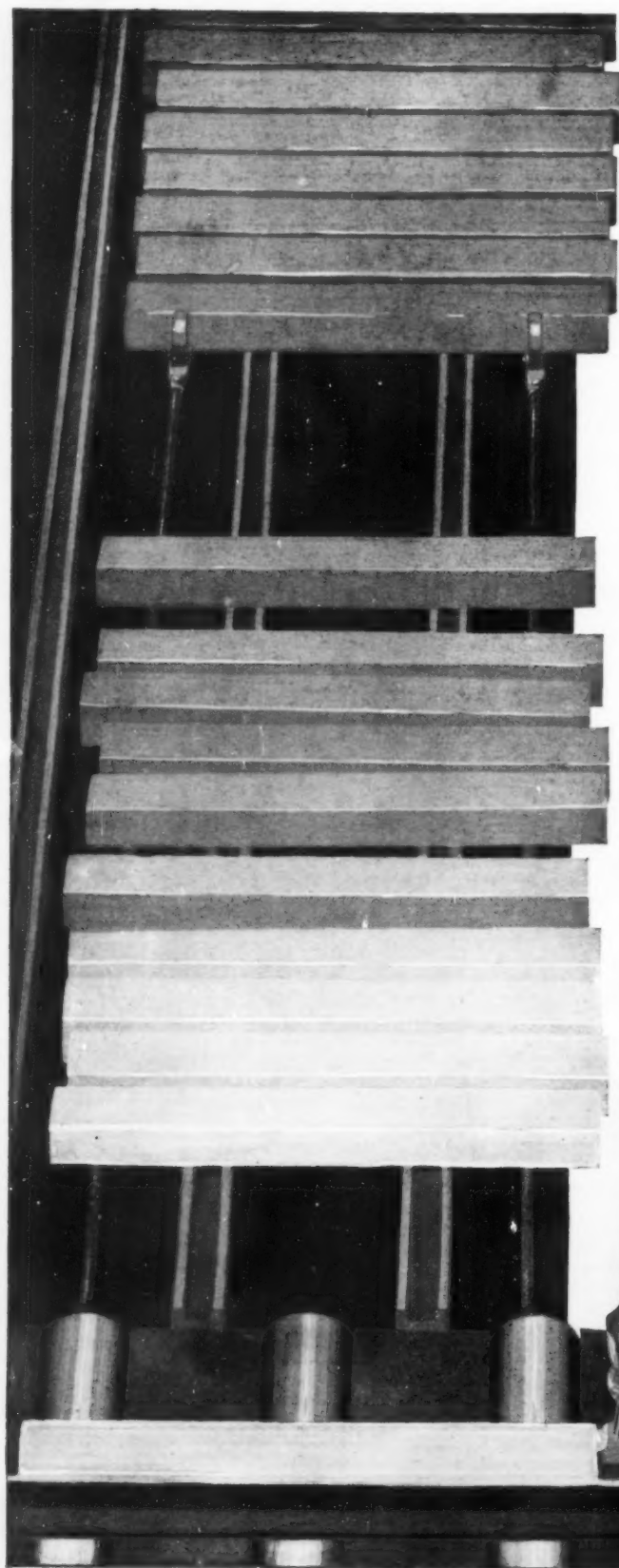
The bearings have the final responsibility. For the bearings support the gears, shafts and wheels. To a large degree car life depends on bearing life. Nothing is more important than the bearings in choosing a car, truck or bus!

Be sure the make you choose is equipped with Timken Tapered Roller Bearings. Thus you can check performance, endurance and economy in advance, as only an engineer could do. The great majority of all makes give you Timken advantages—the exclusive combination of Timken tapered design, Timken-made electric steel and Timken *POSITIVELY ALIGNED ROLLS*—the most enduring design and material ever developed for anti-friction bearings.

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Among our Contributors



PROF. ROBERT H. GAULT

Several years ago Prof. Gault of Northwestern University discovered the possibility of instrumentally communicating the vibrations of speech to the skin of a deaf listener so that words could be distinguished. Since then he has been on leave from the University, working on his discovery with the National Research Council, the Carnegie Institution and the Bell Telephone Laboratories.



COL. E. H. WILCOX

Chief Engineer of a great oil company, the author of the article on lightning prevention at oil storage reservoirs (page 489) is a native of Australia, although for 30 years a resident of the United States. During the World War he organized, commanded and served with the 543rd Engineers. As early as 1903 he designed and built the first oval-type oil reservoir holding over 1,000,000 barrels.

Dr. L. H. Dudley Buxton

On page 493 you will find a chatty, informal narrative of a little "sideshow" put on by the anthropologist, Dr. Buxton, who while on his way home from Mesopotamia discovered that the sands of Arabia are literally dotted with evidences of prehistoric man. The reader, who after reading this, does not at least *wish* he could go to Arabia and hunt for more is subnormal.

Prof. Alexander Klemin

Prof. Klemin, a Russian who came to this country from England, is in charge of the famous Guggenheim School of Aeronautics at New York University. No one in America is in a more strategic position to know what is going on in the world of aviation and to write about it. He contributes his usual department—aviation.

H. J. Lutz

Mr. Lutz of Yale has contributed this month an interesting account of the rehabilitation of an area rendered desolate by a glacier. It takes us into the world of plants and trees, and lays open their world and its internal struggles. Few of us realize that trees are in constant struggle, the same as animals, and only the fittest manage to survive the ordeal.

C. Bond Lloyd

Mr. Lloyd has approached the solution of a mooted question in the playing of golf, from a strictly scientific basis. Not that this means that he is not a practical golf player, for he is. But instead of trusting the eyes or other senses, he has attempted to measure accurately an important golf factor. Read of his experiments on page 522.

Looking Ahead

with the Editor

GAB

That's what some people do on the telephone, and those of us who get our talks over quickly have to pay for it. Why not, then, make the long-winded pay by the minute? That's just what is being tried in Everett, Washington, where every 'phone has its automatic minute-meter. How this works out in actual practice will be revealed next month.

LIGHT

There is about twenty times as much science in the science of artificial lighting as most people realize. Next month Dr. M. Luckiesh, Director of the famous Lighting Research Laboratory of the General Electric Company, will bring some of the same science out of the darkness into the light.

CRASHING

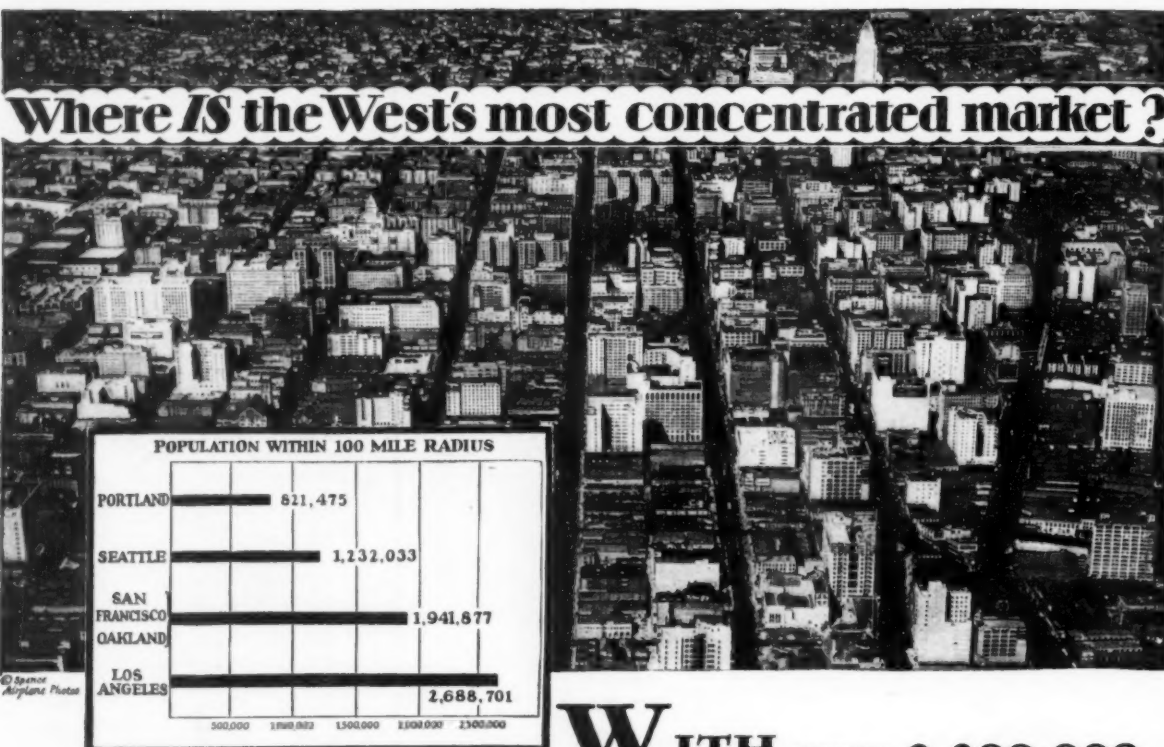
How does an airplane pilot feel when his plane crashes? What are his reactions when he finds that his plane is out of control? These and other similar questions will be answered by Lieutenant George O. Noville, a member of the famous Byrd transatlantic flight party, whose story of his thrilling experiences will be published in our next issue.

PROTOPLASM

Protoplasm lives. Everything that lives is made of protoplasm. What, then, is life? It sounds so easy, yet all we can set opposite the great enigma are theories. Professor Seifritz of the University of Pennsylvania has been performing some remarkably interesting experiments on protoplasm. They will be described by him next month.

AIR

The atmosphere is so commonplace that we overlook it. Prof. W. J. Humphreys, Chief Physicist of the United States Weather Bureau has not overlooked it—in the next issue he looks it over, and tells us what new things science has discovered concerning it. Just what, for example, is in the unexplored highest levels of the surrounding atmosphere?



WITH over 2,200,000 population in Los Angeles County and more than 3,000,000 people in the 14 Southern California counties, 40% of the coast market is within local distributing and trading radius.

This concentrated market is attracting the attention of large industries alert to Westward and Oriental expansion.

These nationally known manufacturers after most careful investigation, have recently established new plants in Los Angeles County.

Los Angeles County manufacturers distribute with economy and dispatch,

FORD MOTOR COMPANY
B. F. GOODRICH RUBBER COMPANY
FIRESTONE TIRE & RUBBER COMPANY
S. KARPEN & BROS.
KROEHLER MFG. CO.
NATIONAL BISCUIT CO.
ILLINOIS GLASS COMPANY
AMERICAN MANGANESE STEEL COMPANY
CONTINENTAL CAN COMPANY
TRUSCON STEEL COMPANY
SEARS, ROEBUCK & CO.

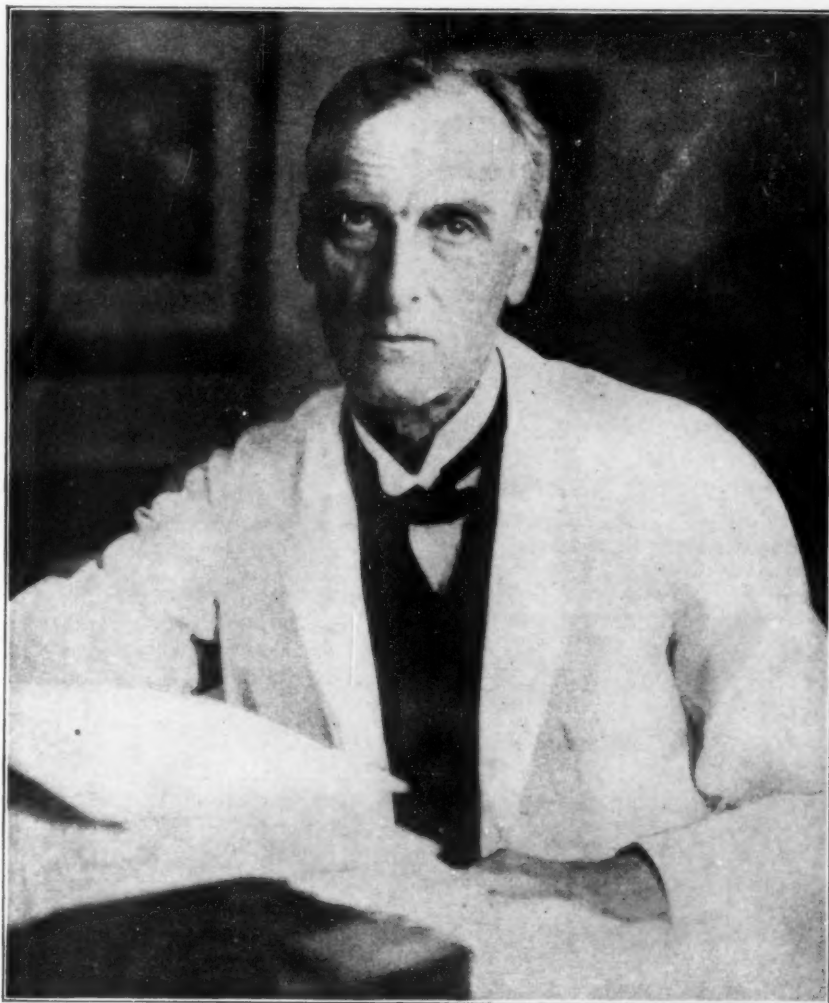
by rail and ocean routes to Western and Export trade.

Unusual proximity to raw materials...cheap fuel... abundant water and power at low rates...labor free from strife...a world harbor...unexcelled ocean and rail transportation...low plant overhead...high efficiency

... all make Los Angeles County the Industrial Magnet of the West.

[Specific information gladly furnished to prospective industries]
[by Industrial Department, Los Angeles Chamber of Commerce]

INDUSTRIAL LOS ANGELES

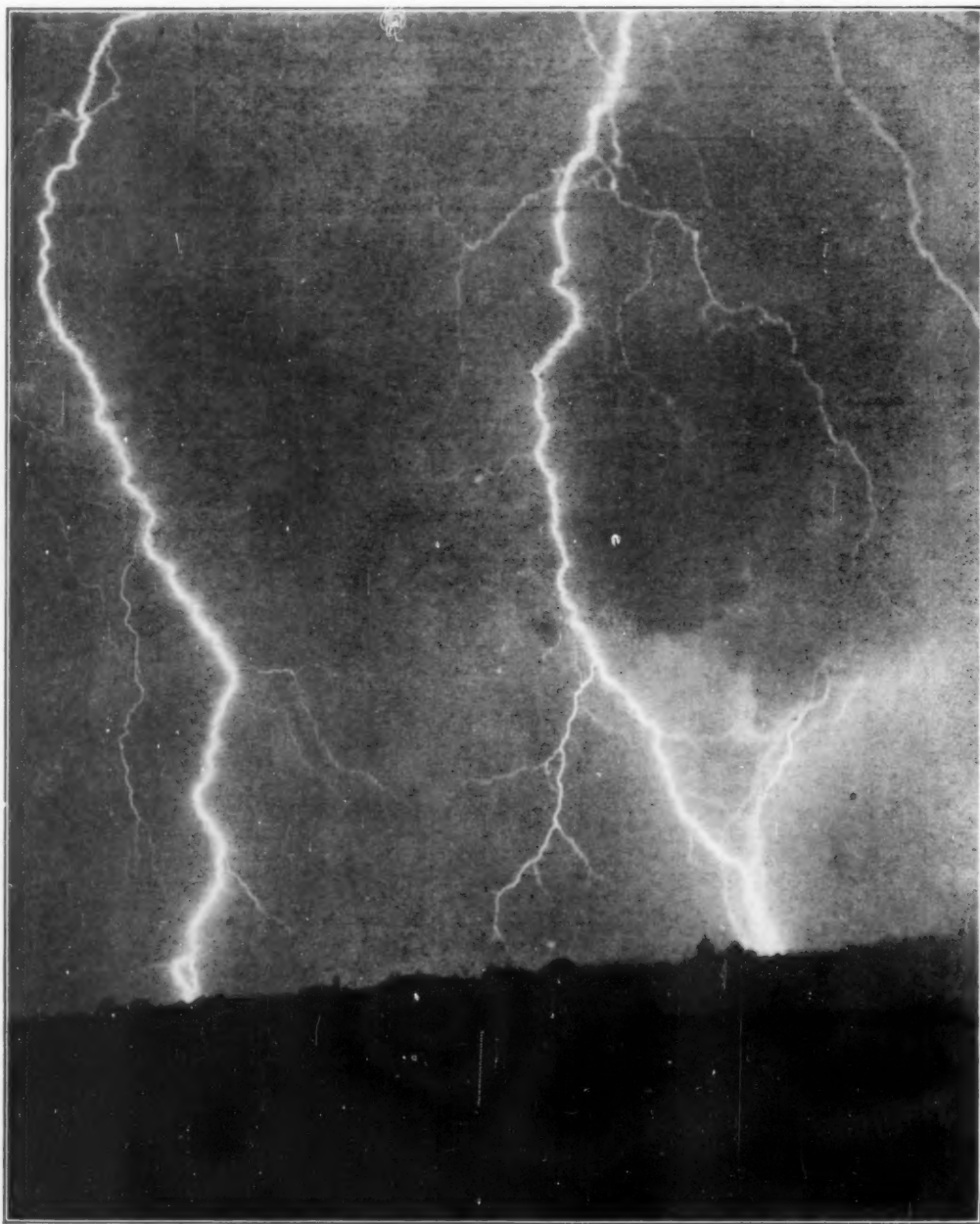


Keystone

SIR ARTHUR KEITH

Famed President of the British Association for the Advancement of Science, his recent presidential address on Darwin's theory of the descent of man has attracted worldwide attention at a time when the modification of some of the minor details of Darwin's original structure appears to have misled a part of the public into the belief that "science has now abandoned Darwinism, and hence evolution." Sir Arthur pointed out

that Darwin's main concept, considered the most far-reaching historical influence of the last century if not of all modern times, still stands like a rock. Author of the noted popular work, "The Antiquity of Man," Keith is possibly the world's foremost authority on the evolution of the human body from that of an anthropoid ape of the Tertiary Period of geology, a duration of a million years and probably very much more.



Lightning in Oklahoma

FREQUENTLY in the plains states, electric storms come and go at short intervals, and it may be possible when looking from a selected vantage point to see several separate storms scudding across an otherwise sunny landscape at the same hour. Amateur photographers find little difficulty in photographing lightning flashes at night, simply leaving the shutters of their cameras open for a few minutes. Despite the fact that considerable research has been per-

formed on lightning, scientists are loath to dogmatize concerning its ways, for it is felt that much remains to be explained. Why lightning performs in what we call its normal manner is fairly well understood, as is made evident in the article beginning on the opposite page, but certain of its antics remain inexplicable. To say, however, that these antics are "abnormal," is erroneous, and is really a confession that we do not yet understand them.

Dece

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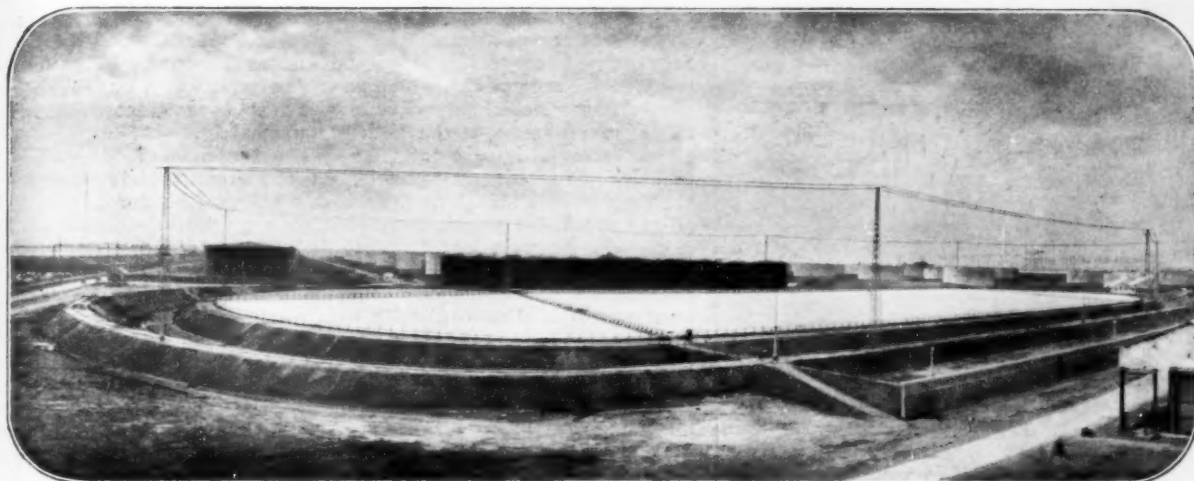
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HOW LIGHTNING DAMAGE IS PREVENTED

Storage tank containing 1,300,000 barrels of California oil—safeguarded against the risk of total fire loss by means of the system of

lightning prevention, not mere protection, described in the article below and illustrated in complete detail on this and the following pages

Lightning Prevention

A New Scientific Method Has Been Devised for Safeguarding Large Areas--Especially Petroleum Storage Tanks--by Actually Preventing Lightning Strokes, Instead of Merely Protecting Them with Lightning Rods

By COLONEL E. H. WILCOX

Engineer's Reserve Corps, United States Army; Chief Engineer, Pan American Petroleum Company; Member, American Society of Civil Engineers

LIGHTNING has always been regarded as beyond human control, but researches of the past year have lead to a completely revised viewpoint, and have offered to the industrial world a new system of lightning protection based on scientific experiment and research, which aims at protecting from the effect of lightning by preventing lightning discharges in, on, or around the objects protected.

The new system has already been adopted by the Pan American Petroleum Company, after an exhaustive investigation, and twelve and one-half millions of barrels of oil are now protected by it. It is known as the Cage system of lightning prevention, and is the invention of John M. Cage of Los Angeles.

THE Cage system primarily protects an area, and incidentally all objects within that area, whether they be tanks, reservoirs, arsenals, storehouses, or barns. It works on a theory diametrically opposite to that of the ordinary lightning rod or tower such as is frequently used for protection. A single tower or a group of towers operate on the theory of attracting lightning discharges which otherwise

would have struck objects in their immediate vicinity, and conducting the charges safely into ground, each tower being credited with the ability to protect a zone proportionate to the height of the tower.

The Cage system, on the other hand, claims to remove the danger of a discharge of lightning taking place in, on,

or around the protected zone. It operates by gathering into itself the ground charges which would have existed within the protected area, and returning them to the charged thundercloud by ionic discharge, so distributed in time and in space that no destructive discharge can take place over, or within, the protected area.

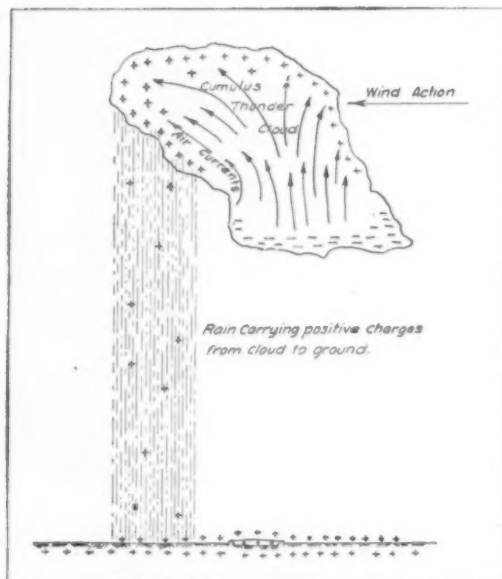


A THREE-WAY TOWER

The function of the wires shown is described in the accompanying article

THIS distribution of the electrostatic charge of the cloud over time and space instead of concentration in time and space changes the type of discharge from an "impulsive rush" or lightning flash to corona leakage, ionic discharge or dissipation, so widely distributed and so reduced in intensity as to be perceptible only to instruments of precision, removing altogether the possibility of direct flash or lightning discharge. This is not the same as the "impulsive rush" described by Sir Oliver Lodge. It denotes the alternate slow charging and instantaneous discharging of a cloud.

In practice, this is accomplished by erecting steel towers of suitable height, completely surrounding the area to be protected, these towers being connected at the top by a cord or ring of wires arranged in a hori-



WHEN DOES LIGHTNING OCCUR?

When the difference of potential between cloud and earth charges exceeds the resistance of the air

zontal plane, and carrying frequent points from which discharges take place, all properly grounded and interconnected electrically with the reservoir or other object which it is desired to protect.

In order to understand the theory of the operation of the Cage system, it is necessary to know something of the formation of charges in the clouds themselves. It is no magic process which suddenly dumps an immense charge of electricity out of nowhere into the cloud. The charge therein is built up by a definite process—one which takes an appreciable time-interval for its operation. The up-rushing currents of air in the cloud cause a separation of charge. In all probability, this is effected partly by subdivision of water particles as they are broken up by the air currents in the cloud, partly by jet action, but principally by the friction of the passage of air over the water particles composing the cloud. All of these act together in varying degrees to cause a separation of the positive and negative electrical elements in the cloud, resulting in the phenomenon which we know as a charged cloud.

THE negative electrons usually remain in the cloud, concentrated in its lower zone, while the positive electrons are carried upward and outward, and frequently are finally brought down to earth with the rain. This process is occasionally reversed, the positive remaining in the cloud, and the negative brought to earth.

In either event, the presence of the charged cloud imposes by influence an equal charge of opposite potential on the ground beneath. This is fre-

quently intensified by the charge brought down with the rain, while the electrons of opposite potential in the ground are expelled laterally by the influence of the cloud. This is illustrated graphically in the first of the diagrams on this page. In any event, the presence of the charge in the cloud imposes by itself an equal charge of opposite potential on the ground. When this difference of potential between charges exceeds the air resistance, it breaks through and that phenomenon which we know as a flash of lightning occurs.

Simultaneously with the occurrence of this flash of lightning or primary discharge, there may occur numerous secondary discharges or sparks of lesser magnitude in or among objects in the vicinity of the primary discharge. The

explanation of these secondary discharges is that, prior to the primary discharge of the cloud in the lightning flash, the ground and all objects on it within the influence of the cloud are charged with the ground potential.

BECAUSE of the existence of the charge in the cloud, these ground charges are bound, but they seek to liberate themselves, restoring electrical equilibrium simultaneously with the primary discharge. If these charges are provided with ample direct and unbroken paths of good conductivity or low resistance to the center of impact of the primary discharge, they follow these paths and the charge is released without spark. On the other hand, if there be any break in the continuity of these paths, or if a zone of high resistance intervenes, or if they be indirect or insufficient, then the charge will spark across its line of least resistance to the ground or to a conductor leading to this center of impact.

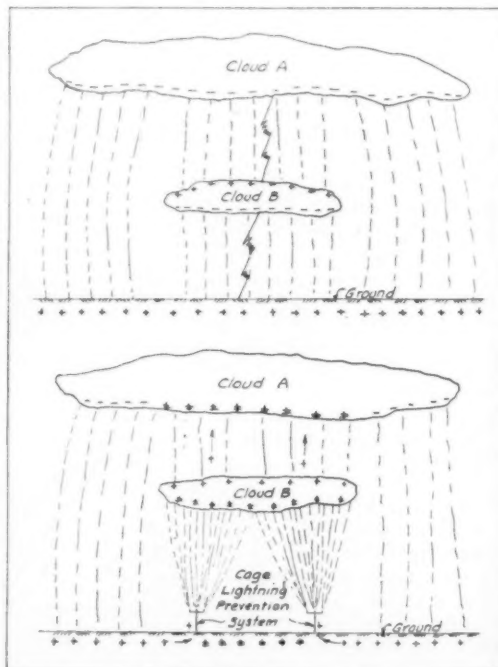
These sparks may vary in length from the infinitesimal to several feet, depending altogether on the circumstances in each individual case, the intensity of the charge, the capacity of the body, and its distance from the center of primary discharge. In any event, the secondary spark, whether small or great, is a source of grave danger,

being probably responsible for many more fires than are primary discharges. Should this spark, no matter how small, occur in the presence of any inflammable or explosive gases, disaster follows immediately.

Lodge's conception of "impulsive rush" is that a large and highly charged cloud at a higher elevation suddenly unloads on a neutral cloud beneath, which cloud in turn, being suddenly overloaded, dumps its charge to earth. This idea comes from a false analogy. There is no similarity between it and pouring a stream of water from an elevated vessel into a lower one until it shall "tip," as it were, dumping its contents on the ground beneath.

THERE is no such thing in nature as a highly charged high cloud and a neutral cloud beneath, unless we assume the false premise that the lower cloud is equally non-conducting with the air in which it floats. A cloud is not as good a conductor as metal, but it is far from being a non-conductor. Under the influence of the charging cloud A, (see the second diagram on this page) there will be a separation of charges in B, positive concentrating in the upper and negative in the lower portions of the cloud, with such stray lines of force as may be reaching the earth direct. Here, the stress is primarily between the two clouds, with a secondary stress from the lower portion of the cloud to the ground.

In such a situation as assumed by Lodge, with a Cage dissipation system functioning, the cloud B would not



IS SIR OLIVER LODGE WRONG?

According to the author, his "impulsive rush" concept is incorrect. See the accompanying text

hold an equal separation of positive and negative charges, the negative in the lower portion being constantly neutralized by the upward convection currents of positive ions from the ground. It would, therefore, tend toward an excess of positive. Meanwhile, other positive ions from the ground are also neutralizing the charge in cloud A. If a discharge of any kind could occur under the circumstances, it could be only between clouds A and B, as the stress between the ground and B has been relieved. Any discharge would neutralize A and B, or neutralize B with reduction of charge in A, depending on the relative capacities of the cloud. It would so reduce stresses between A and the ground that there would be no possibility of discharge between them. This brief picture of the nature of lightning is necessary to enable the reader to understand its action.

THE new system of lightning prevention aims at the reduction of the charge in the cloud by gathering up into itself the earth charges within the protected area, discharging them to the cloud in such degree and manner as to neutralize the cloud charge so that no primary discharge of any kind can take place.

A few simple but fundamental electrical and magnetic phenomena will help to make this action clear. If a disk of metal be completely charged with electricity of either potential, this charge will be found to reside most strongly on the periphery of the disk, and almost lacking at its center. If, now, an encircling ring be brought into contact with the disk, the charge will

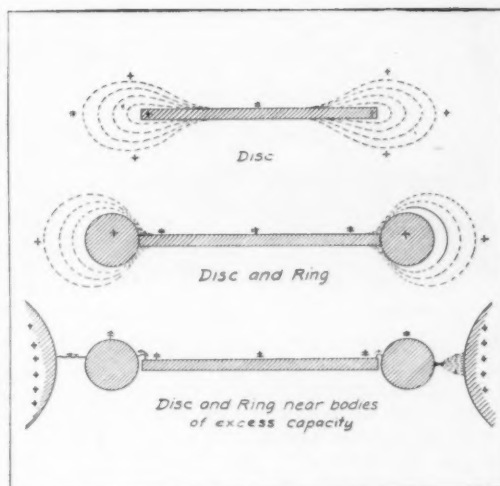
be found to have left the disk and to be resident in the ring up to the capacity of the ring to receive it. If this ring in turn be connected to a receiver of unlimited capacity such as a ground, or if means be provided by which the charge can again pass to this receiver, both disk and ring will quickly be completely discharged. This is shown in the third of the diagrams, reproduced at the right.

If two metal spheres of equal diameter, charged with electricity of opposite potential, be approached but not brought within sparking distance, it will be found that these charges will persist for long periods of time. If, however, one of these spheres be provided with a sharp point, directed toward the other, then the transfer of charge will be greatly accelerated and in a brief period of time both bodies will be completely discharged.

These principles are now being recognized and made use of. A cordon or ring of wires around and above the protected area is brought into electrical continuity with that area and with every object within which it is desired to protect. This results in an immediate tendency for outward flow of the previously bound current to the wires.

THIS, however, would have little if any effect if the protection stopped here. The wires would speedily become charged to their capacity and the interior charges would not be materially affected. However, these wires are provided with numerous spaced sharp points from every one of which these charges can pass by corona discharge, ionic leakage, or dissipation. The liberated ions carrying these charges go directly to the nearest body of opposite potential (which in this case is the cloud), each positive on its arrival seizing, satisfying, and neutralizing a negative, thus removing a potential from the ground and neutralizing that in the cloud. This is illustrated in the last diagram on page 491.

The practical questions which presented themselves for solution were: At what rate can such a system liberate its charge to the cloud by dissipation, or ionic leakage? What can be known of the charging rates of the cloud and the amount



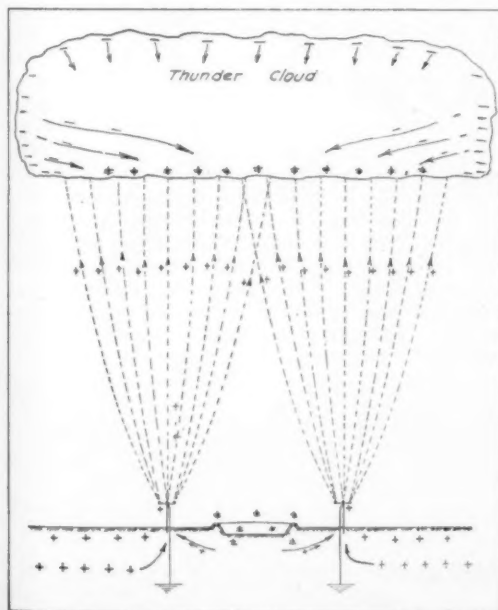
EXPLAINING THE NEW SYSTEM

A simple little experiment which can be performed by anyone with simple equipment

of energy which must be taken into consideration in order to assure complete protection? What must be considered as the minimum area of cloud and ground which must be included in such a system, in order to be effective? What general mechanical arrangement will give the optimum combination best to produce the desired results?

Numerous experiments by the inventor and the writer, extending over some eight months of time, were necessary to answer these questions. Naturally, many false steps were made, as there was comparatively little in past experience to guide us. Many types and combinations of points and wires were tested. Finally, a three-wire system was determined as giving the optimum results.

EXPERIMENTAL work was carried on in two laboratories. For qualitative work, a miniature "cloud" consisting of a disk of small mesh wire netting about five feet in diameter, with a heavy wire ring reinforcing the perimeter, was used. The cloud was charged with direct current, both negative and positive potential being used, and observations and measurements were made with respect to miniature oil reservoirs beneath. A cloud thus charged would spark across six to eight inches of air to the unprotected reservoir or tank, while the same cloud could only spark across approximately one-fourth inch with the protective system in place, this spark invariably being to the protective system, never to the oil. In other words, the voltage stress between cloud and ground was reduced from that necessary to break down six to eight inches of air dielectric—say 60,000 volts—to that necessary to break down one-fourth inch—say 2500 volts.



HOW IT ACTUALLY WORKS

From the wires the corona discharges pass, continually neutralizing the charges in the cloud



3,241,000 BARRELS

The extreme ends of two immense oil reservoirs containing, respectively, 1,500,000 and 1,741,000 barrels of petroleum, show in the foreground. The Cage system, so called because invented by Mr. John M. Cage, protects both reservoirs by preventing lightning, a case of the proverbial "ounce of prevention"

The quantitative tests were made in the laboratories of the testing department of the Southern California Edison Company at Alhambra, where there were available transformers with capacities of 250 kilowatts and 250,000 volts. Here sparks 31 inches long could be secured. As these could not safely be struck to oil-filled vessels, metal tanks were substituted. A metal cloud 12 feet square and a dissipating system with external dimensions 10 feet square were used to determine the amount of current that would flow, without flash, by corona discharge, dissipation, or leakage, at varying gradients. Alternating current only was available.

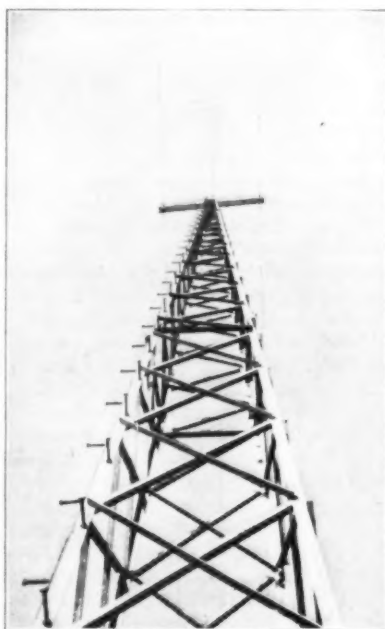
Our practical installations consist of a system of three parallel wires arranged in a horizontal plane and spaced four feet, center to center, with dissipating points at intervals not to exceed six inches, which repeated experiments showed to be about the optimum spacing for such a system.

It is interesting to note that with a high hanging cloud, there is much greater unit value of discharge at a given gradient than with a low hanging cloud. This has been confirmed by numerous experiments. As all laboratory experiments were made with comparatively low hanging clouds, this gives a promise that the dissipative action of a system may be even greater than the experiments indicate.

There is a great popular misconception as to the amount of electricity in a lightning flash, and the power which it represents. This is due to its spectacular appearance, its little understood and apparently uncontrollable nature, and to the disastrous effects which occasionally follow a discharge. This is not a proper basis on which to judge. A stroke of lightning may split a tree, but so will a stick of dynamite. A stroke of lightning may fire a barn, but so will a match. Lightning produces disastrous results because of its intense concentration both in time and in space, rather than the large quantity of electricity in it. The duration of a lightning flash is extremely brief, frequently less than one one thousandth (.001) part of a second, and this released energy is confined to a very narrow channel, the path of

the flash. This path is seldom if ever greater than from four to six inches in actual diameter. Thus there is intense concentration both in time and in space in the lightning flash.

The building up period of the charge, so released, takes an appreciable time. It may be as short as 50 seconds. It



LOOKING UP

This is one of the single towers shown in the first illustration of this article

may be five minutes or even longer. With the charging period as brief as 50 seconds, there is a ratio of 50,000 to one between the charging and discharging periods. If this charge can be dissipated simultaneously with its

generation, and not allowed to accumulate to the break-over point, so releasing itself in an "impulsive rush," a very small amount of energy is all that need be handled in a given unit of time.

Analogy will perhaps best illustrate. Imagine a water tank on top of a very high tower. Into this tank a constant stream is flowing, this stream representing the charging rate of the tank (or cloud). Numerous small holes radiate outwardly near the bottom of the tank and are so arranged as just to balance the incoming stream when the tank is nearly full. These numerous small streams, falling from a great height, acted on by wind currents, will be broken up into tiny drops, and will distribute themselves as a gentle rain over a considerable area. This is distribution of the incoming charge in time and in space. It can go on indefinitely without harmful result.

On the other hand, think of this same tank without any such relief, but so designed that when the water reaches within a few inches of the top, the tank will suddenly tip, releasing its entire charge at once. This will come as an "impulsive rush" or deluge on the ground immediately beneath the tank, probably washing its foundations away. This is concentration in time and in space.

In each case the amount of water handled over a given interval of time is the same, but in the first instance, the discharge is harmless and in the second it is destructive.

The action of a properly designed Cage system, under the influence of a charged or charging cloud, will be that, as the charge begins to build up in the cloud, a small but steady release of ground charge back to the cloud will occur. Until this rate of discharge balances the charging rate of the cloud, the potentials between cloud and ground will rise. This rise in potential means in turn an increased rate of discharge from ground until equilibrium is established, at which time the discharge of current from the earth to the cloud will balance the charging rate in the cloud itself. When this point is reached, equilibrium will be maintained and at a potential gradient so low that there is no possibility of a lightning flash.

MORE PREVENTION

Still another east California oil reservoir, holding 4,030,000 barrels, safeguarded by the Cage invention. Due to a temporary over-production, the producers recently faced the necessity of storing immense volumes of petroleum in open reservoirs



Pre-Sumerian Man

From Unknown Arabia New Evidence of Prehistoric Man of as Early as 20,000 B. C. Has Been Discovered

By L. H. DUDLEY BUXTON, M.A., F.S.A.

Published by courtesy of Discovery (London)

OUR journey, from Kish, in Mesopotamia, to Jerusalem, was one of the most interesting and fruitful times I have ever spent, and even now it seems hard to think that we packed so much into four days.

On our way out we had found some stone implements which, while undoubtedly the work of early man, were few and indefinite; we wanted to find more. Fortunately for ourselves, on the return journey the Air Vice-Marshal gave us permission to go out into the desert with the armored-car patrol, and we practised archeology under extremely strange conditions.

Our party included Henry Field and myself, archeologists and civilians, and a detachment of the Royal Air Force, with armored cars. I think that we were first of all regarded as extremely mad; out East, however, the afflicted of Allah are always regarded with compassion, and before very long the detachment were as afflicted as ourselves—but that is a story I will tell in its proper place.

We did a short journey the first day along the Euphrates to a place called Ramadi, which is a "desert port" in the same sense that the camel has been called, *ad nauseam*, "the ship of the desert." All along the Euphrates there are a series of towns from which the caravans start out on their hazardous journey across to the Mediterranean; west of them there is no permanent habitation until the borders of Moab are reached. For ourselves—for the armored cars were coming back the same way—there was one place where water could be obtained, and only one, after we had left Ramadi.

WE started off at dawn and it soon began to rain—not desert weather, perhaps, but it does rain even there—and we were miserable till lunch time, when it cleared up, and we halted in rolling country, to make our first find, a flint implement, but not of any type which could be recognized. We halted for the night nearly 200 miles from Ramadi, at Rutba Wells, our one watering place.

I was the only person in the party who spoke Arabic, and that not well,

so it fell to my duty to accept the hospitality of the desert police, while Field hunted for flints and only found one, and the detachment worked at the cars. I sat cross-legged on a sheepskin in a black Arab tent, drank tea and coffee and smoked, and got several useful pieces of information. I asked whether the Arabs ever used flint to-day as knives, and showed them some I had found on the way out. They were very scornful. Those were of no use; the Bedouins sometimes used flints to make fire, but not useless pieces like that. I had one or two flakes that looked very modern, but the people who use the strike-a-lights repudiated them. This was cer-

Nassar or Nazr was that of a local saint—the word actually means "savior." The name is a common one in many parts of the middle East, and we had, as a matter of fact, had a servant of that name at Kish. On the other hand, Professor Langdon was at first inclined to believe the name to be a survival of a vague memory of Nebuchadnezzar, in much the same way perhaps that in Cyprus, for instance, to-day it is perfectly certain that modern saints preserve a memory of forgotten ancient shrines.

IN this case the name would be an indication that there existed a city whose very site perhaps has been forgotten, but whose vague memory has lingered on for so many centuries.

Nazr was easy to find, as the desert police gave us clear instructions, but although we searched carefully we got no definite archeological data. There were some vague stone ruins of a well, now dry, but beautifully preserved, the construction of which can be seen in the accompanying illustration; and that was all. There were no traces of the potsherds or bits of broken crocks which strew the ground in their thousands on any old city site, and had there formerly been any settled habitation on the spot even our short visit would have shown us at least some traces. But there was nothing, just a few stones, obviously the foundation of some post, possibly a *qsar* or guardhouse on the road, and a well—nothing to indicate that many men had once lived and fought and died in this remote spot.

The name Nazr, then, at least in this instance, turned out to be unreliable as a guide to the finding of ancient Babylonian cities, and the Professor and I are now inclined to regard it as a name of a local saint whose origin, however, is as yet obscure.

We climbed into the cars again and went farther into the wilderness. Sixty miles from our starting-place in the morning we punctured a tire—a fortunate chance, for while the detachment labored with the huge tires, Field and I ran round, eyes glued to the ground, and began to find things. We each

What Will Arabia Reveal?

ARABIA is a land of mystery. Only a handful of daring explorers have crossed its arid, burning desert, braving its wild tribesmen. Of these the author of the accompanying article, a noted British anthropologist, is one. Finishing a season's excavation at Kish, in Mesopotamia, with the joint expedition of the Field Museum (Chicago) and Oxford University, he, with Mr. Henry Field, returned by way of the Arabian Desert. There they hastily sought and found evidences of ancient man. The fact that Europe abounds with such evidences shows merely that more searching has been done in Europe. Asia will bear watching.

The Editor

tainly quite an auspicious beginning.

Then I asked about old ruins. Were there any in the desert? They told me there were some at Nazr, a few miles away, and that there was a well there too, but dried up. Beyond that they knew of nothing. So we talked and smoked and drank coffee. All this sounds very prosaic in the telling, but in an Arab tent with a lantern hanging from the pole, a brazier of camel thorn giving an intermittent red glow, and a gathering of swarthy-faced desert police, hung around with scimitars and other lethal weapons, it was really a very pleasant way of spending an evening, although so far our quest had been unsuccessful.

Next morning we soon came to Nazr. This place was of particular interest because it was to shed further light on a problem met with on our expedition to Kish. We had there excavated a site in the desert south of Baghdad called Jemdt-en-Nazr, and I was of the opinion that the name

went out in opposite directions, although never more than a hundred yards or so from the cars. Every now and then I heard Field shout "got one," as he stooped down and picked up an implement. This unknown spot in the wilderness gave us some of the most definite information we obtained about Paleolithic man. If anybody wants to go and find more—and there are plenty to be found—it is close to Landing Ground R. (see map, page 495), which is marked on the air maps, and on the map the Royal Geographical Society has published of this area.

I did not realize the importance of my finds here until I went over them later, and they provided me with definite evidence of late Paleolithic man of the period usually termed Aurignacian, in Europe, about 20,000 B.C.

After the puncture had been mended, we had no more luck, although we stopped once or twice. We halted for lunch at a crashed airplane. The spot is known universally as Maitland's Monument, after the name of the man who crashed, though he was not killed. We searched here again very thoroughly but found nothing, and stopped for the night about a hundred miles farther on, at a place nearly surrounded by low hills and enclosing a shallow desert lake. Here we had found implements on our way out, and we hoped for great things. It was getting dark when we pulled up, but we had a look round and found a few flakes.

THAT evening, after the cars had been nursed and put to bed and the day's work finished, the men made a fire of camel thorn and asked me to tell them something about Paleolithic man. I have seldom had so keen an audience—there was a little circle seated on empty petrol drums, the fire-light flickering on their faces, and outside the circle nothing but the wilderness. So I told them what little I could about the people who lived in that desert probably more than a hundred centuries ago. A man every now and then heaped more fuel on the fire from the pile they had gathered and Field demonstrated on the implements that we had found. The lecture was not perhaps very highbrow, but it had great practical results. The rest of the time the men spent their scanty leisure looking around and found quite a big proportion of our specimens.

Then the men cast lots for turns at guard. On the desert patrol the officers take turn and turn about with the men under their command, and our host had the first watch. I sug-

gested sharing it with him, so we inspected the camp and put out the fire lest we should be a mark to desert raiders. We walked around and around the cars, and talked softly of what the place must have been like when the makers of the implements lived there. Great changes have clearly taken place. The spot was at least a hundred miles from the nearest permanent water. There was a little pasture when we were there and some water in the desert pools, but in the summer the ground is parched and dried up. To live there without camels would be impossible, with them difficult, but the desert Bedu seem to survive on only camel's milk, and the camels are the nearest thing to perpetual motion in producing milk without much pasture that ever existed. But even the



ANCIENT WELL AT NAZR

Not, however, the work of prehistoric man. Arabia's climate has not always been arid, geological evidence shows

most hardy Bedouins could not live there permanently.

Yet we found definite evidence that man had, long ago, lived there and up on the high desert near Landing Ground R. Further, there is no evidence at present that Paleolithic man ever domesticated camels, although the history of that animal's association with man is not very well known. The problem seemed a difficult one, and my host was inclined to suggest that the stones were made by Bedouins, though he admitted that they were obviously very old, as the surface even of the worked parts was highly polished by the action of the wind blowing dust against it. Such polish takes a long time to acquire.

However, the solution is fairly simple. In western Europe, where

the Old Stone Age has been thoroughly studied, we know that during that period the climate was very different from what it is now, and that the ice-cap reached much farther south. Climatic conditions over the whole world must have been very different, and there is every probability that there was a good deal more rain in the north Arabian desert. It is unlikely that there was ever any heavily-forested region there, but a little more rain would serve to convert that poor steppe into quite habitable country, and make it possible even for primitive hunters to live there. After we had gained a little more experience, we found that worked flints were found principally in small hollows and little dry valleys, although this was by no means an invariable rule. It may well be that in the remote period, when man was living there, water flowed down the valley bottoms, and possibly there were even burbling streams.

SO we talked under the stars, watching the horizon with our field-glasses at intervals, but we saw nothing and turned in when the end of our watch came. Next day as soon as breakfast was over, Field and I started out. We were told not to go out of sight of the cars, and we put on revolvers to signal with if we saw anyone. I have never done archeology before looking as if I were prepared to repel boarders or engage in other military feats of arms.

We met with no adventures and made many finds, some obviously very early flints and others of later date. At the bottom of the hollow, near the Air Force Landing Ground H, we found a large lake possibly a hundred acres in extent and nowhere more than a foot or so deep. Owing to some trick of

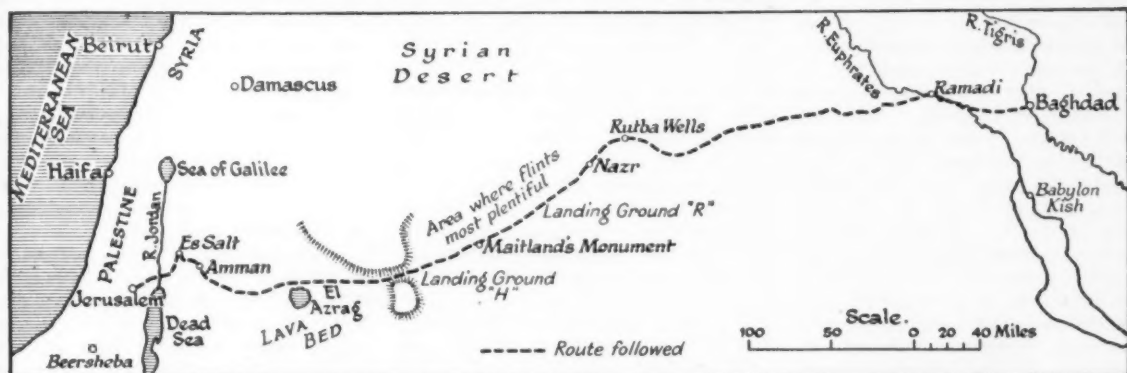
Nature there were clearly two surfaces. On the one we found no evidence of man's handiwork. The lower surface, about a foot deeper, seems to have been exposed in ancient times, and here we found a large number of small flint tools. Luckily, in some places the upper surface had been removed by wind or other action, and the older floor was exposed. We wandered about for some time before we understood exactly what had happened, and we were disappointed that at first we found so little. Afterwards we knew where to look.

We returned to camp with full pockets and very sore heels, to find that after the cars had been cleaned and looked over, the detachment, instead of going to sleep—which as the sergeant said to me was "indicated"—

had turned themselves into archeologists and had searched for flints. What is more, they had found them, and flints of a later date than those we found at the bottom of the depression.

rivers only material which suggests a fairly advanced culture has been found, nothing primitive has come out of the mud of the Tigris and Euphrates. Here, on the divide between Mesopo-

hunted on these wild uplands. My little arrow-head may possibly bridge the gap to a certain extent and indicate a race of more advanced hunters, but it is by itself uncertain evidence.



MAP OF THE AUTHOR'S JOURNEY FROM MESOPOTAMIA TO PALESTINE

The trip traversed the northern portion of the great Arabian Desert, which stretches for hundreds of miles to the south and is peopled with tribes even wilder than the Bedouins—in fact there are tribes which the fiercest Bedouins fear

I cannot say why at one time man had lived in one spot and later migrated to another higher up on the hillside, but at least in that place they did, possibly owing to a change in climate.

During the afternoon we met a tribe of wandering Bedouins on the move—a singularly Biblical occurrence, for while peace was literally on my lips (for that is the desert greeting) we made ourselves ready for battle, without fortunately having to do more than make a demonstration. We slept one more night with the armored cars, and got up at dawn to wait for the mail convoy which was going to take us on to Jerusalem. It was icy cold in the grey before the dawn, although so hot in the daytime, and the men called it "a short course in death," but a fire of camel thorn soon gave us hot tea and rabbit stew and we then felt better.

THE convoy came along and we said goodbye to our excellent hosts, who started on their 500-mile journey back to garage after doing a little more patrolling to see that the King's peace was being kept. We had a few punctures and found implements at nearly every stop.

When we arrived in Jerusalem our pockets were bulging and Field's attache case was overburdened, so until we reached home again we hardly knew what we really had found. A careful examination later, however, showed us that our finds belonged to the middle and later periods of the Old Stone Age, probably the oldest dating from as early as 20,000 B. C. We also found a beautiful little laurel-leaved arrowhead belonging probably to the New Stone Age.

Briefly the conclusions which can be drawn from the evidence collected are as follows: In the valley of the twin

tamia and Palestine, we have definite traces of the existence of man in all likelihood very many hundred if not thousands of years before the rise of the great Sumerian civilization. We have evidence which suggests an entirely different climate and conditions from those which prevailed in Mesopotamia since the earliest times we can trace in that region.

Although many of the implements were found far away in the desert, yet

The Sumerians were very accomplished agriculturists, using an elaborate system of irrigation. Such a system, although when learned from other more advanced peoples may be practiced by comparatively primitive peoples, takes many years to build up. The Sumerians, however, were far from being primitive; they had behind them a long and elaborate but as yet unknown history.

THESE flints take us back into another world. We do not know, of course, what Mesopotamia was like, nor do we know what was the relationship between the valley people and the highlanders. The former may have already been quite advanced, but we have now definite evidence that there was a culture which definitely preceded the earliest Sumerian city known. There is a gap which is yet to be filled. We have primitive hunters on the plateau long before the dawn of history, away in the valley, at about half the distance between London and Edinburgh; we have possibly thousands of years later, when history begins, an advanced civilization. The evidence for a Babylonian culture on the plateau is, I have tried to show, doubtful.

One further point remains. Man is known to be conservative in his physique more than in his culture. It is a noteworthy fact that in ancient Kish and to-day among the modern Arabs there survives an ancient physical type, closely resembling a type living in western Europe in Aurignacian times. It is tempting to suggest that the ancient Kishites and their modern representatives are the actual descendants of the primitive pre-Sumerian hunters who were living in the North Arabian desert many years before it became a desert.



MOUSTERIAN AX

Type of workmanship performed by Neanderthal man, 50,000 years ago

we found a few quite close to the River Euphrates. We searched carefully in Mesopotamia itself and found nothing very early, nothing before about 3500 B. C., a long time ago but only a short time compared with the immense period which must have elapsed since Mousterian or Neanderthal man

OUR POINT OF VIEW

HARPIES

THAT inventors are tempting prey for unscrupulous sharpers and shy-sters is one of our traditions, but, in the case of this tradition, there is much truth in the belief.

The plans of the schemers seem all the more plausible because they apparently ask no money from the inventor, but only a percentage of what they make for him. For example, a firm of "patent promoters" would obtain an inventor's name from the Official Gazette when his patent issued, and begin correspondence which terminated in a contract by which the "promoters" would undertake to sell the patent for a percentage of the selling price.

A month or two later the inventor would be informed that the promoter had a buyer who would take the patent over, provided the patent was valid and the article could be manufactured economically. To satisfy the prospective customer, the promoter had to make an "engineering and patent report." This the promoter will gladly supply upon receipt of 25 dollars, (although a really comprehensive and valuable report costs several hundred dollars). When the inventor paid his fee and the report was made, the interest of the prospective buyer had evaporated; in fact, the patentee never learned the identity of the mysterious buyer.

While the Post Office Department ended the activities of a group operating in that manner, there now is a new scheme in operation, a variation of the former which is just as dangerous. The inventor receives a letter from a firm of so-called promoters, saying they are interested in the patent he has just obtained, and asking him his selling price. The inventor sets a price, whereupon he is told that a sale can be made if he furnishes a favorable "infringement report." For this purpose the promoter recommends a Washington attorney whose opinion would be acceptable to the purchaser.

If the inventor retains the attorney suggested to him, he can expect one of two things, either that the unnamed prospective buyer has changed his mind, or that the "infringement report" is unfavorable. In any event the inventor has paid a fee and has nothing to show for it but his experience.

ROMANCE OF RAILROADING

ANYONE who believes that romance has passed entirely out of modern life should have sat with the writer on the grandstand at the Centennial Pageant of the Baltimore and Ohio Railroad and watched the historical locomotives of the past 100 years

pass by in stately procession under their own steam. Headed by the diminutive "Tom Thumb" of 1829, built by Peter Cooper, there followed in their historical order some two dozen locomotives, nearly all of them the originals. It made one feel as though the long-familiar drawings from books of early locomotive history had come to life, clothing themselves in actual iron and steel, and had gathered at the call of the Baltimore and Ohio officials to render this extraordinary pageant the great success that it was.

God bless the genius on the staff of the Baltimore and Ohio, say we, who

WHY NOT THE "AMERICA'S" CUP

AMERICAN sportsmen have been frank in their admiration of the feat of the Scandinavian yachtsmen, who have "lifted" two famous cups in the recent 6-meter boat contests on Long Island Sound. In doing this they met the best boats of America, Great Britain, Denmark, Holland and Italy, and defeated them so handily that American yachtsmen frankly admit that the Scandinavian challengers represent a marked advance in smaller yacht design over anything we can turn out today. The victory of the Scandinavians will be excellent for the promotion of the sport.

The designer of the Swedish *May-be* should be able to turn out a worthy challenger for the America's cup. He need not go above the length of 65 feet waterline. The America's cup contest needs revitalizing. A challenge by Sweden or Norway, because of the recent victories, would arouse enormous interest.

gave us this this faithful historical display. It should be made permanent, let us say in Washington or New York.

WOE TO THE FIGHTING PLANE

ONE of the most commendable and successful post-war activities of the army is the institution of the Army Ordnance Association, which seeks to hold together, in fraternal military interest, the thousands of civilians who gave their time and services to the country during the war. An important annual item in the activities of the Association is its gathering at the great Aberdeen Proving Ground to witness an exhibition of the good work which is being done there. Most reassuring to those who feared an early loss of interest in ordnance similar to that which had occurred after other wars, is the fact that the attendance

has grown from so many hundreds to a total of some five thousand, which was approximately the number gathered at Aberdeen during the October meeting.

For the entertainment of the visitors, the Army Ordnance prepared a program which really consisted of a working exhibition of the very fine new ordnance developed since the war, which we illustrated in our issue of July last.

Most realistic was an attack by tanks on a line of machine-gun nests, upon which they advanced remorselessly, to climb over and flatten them out under their great weight. But the most impressive and spectacular work was that done by the anti-aircraft batteries in repelling a night attack by airplanes. The target, towed at a height of 7500 feet and at a distance, on a straight line from the guns, of two and one half miles, was quickly found and cut down.

SNOW REMOVAL PAYS

THERE are 36 states situated in the snow belt of the United States. The first flurries of snow have been reported and the season is close at hand when every state and local community should be prepared, with prompt and effective snow removal measures, to keep clear the highway routes.

The American Motorists Association states that the motor vehicles registered in the 36 states of the snow belt involved a purchase cost of seventeen and one-half billions of dollars, and it estimates the amount required for their upkeep in tires, garages and fuel at over five billions of dollars annually. Now, unless effective snow removal measures are adopted, there is no return on this huge investment of over twenty-two billion dollars, for periods ranging from a few weeks to several months.

This is a problem that seriously affects, among others, the farmer, the school, and the postal service. Snow and ice accumulations on the highways prevent the transport by farmers of their products and supplies during the closed season.

It is estimated that this season, in the 48 states, 750,000 pupils will be transported to the 15,500 consolidated schools in motor buses, and an equal number in other types of vehicles.

Consider the postal service. The Post Office Department advises that 31,600 rural free delivery vehicles use 869,000 miles of roads over the 36 snow states, and serve 21,206,400 patrons. This vital service can be rendered without interruption, only if the highways are continuously kept clear of ice and snow.

Life-Saving Airplanes

Aircraft Are Now Employed For Carrying Life-Lines to Ships in Distress

By S. R. WINTERS

OVERTHROWING a precedent of nearly one hundred years duration, something new—the airplane—enters the service of life-saving. The present-day interest in aviation, stimulated to the point of accepting the miraculous, finds added impetus in an invention of Lieutenant-Commander C. C. Van Paulsen. About five years ago, Commander Van Paulsen quietly began experiments at the recently abandoned aviation station at Morehead City, North Carolina, and has perfected a revolutionary method of throwing out rescue lines by aircraft. This method has been adopted at two aviation stations of the United States Coast Guard, located at Gloucester, Massachusetts, and Cape May, New Jersey.

The old tar who related his narrow escapes and gave full credit for his deliverance to the "breeches-buoy" would indeed have something to tell

tached, to the ship in distress. The stricken crew seized this line and made fast a cable carrying a large life-preserver to which was attached a pair of canvas trousers, with lines for hauling the "breeches-buoy" to and from the disabled vessel. One by one, the stranded crew stepped into the "breeches," which formed a sort of cushion for the life-preserver, and were towed safely to shore.

AND now, the airplane has been accepted by the Coast Guard of the United States Treasury Department as the vehicle for carrying out the life-line to ships in distress. In this radical safety measure, the line on shore is coiled around a number of upright sticks, attached to a wooden frame. The rope is so wound around these sticks as to pay out freely when an airplane is taking the line to a disabled vessel. The end of the life-

off, picking up the rope, which is held taut by the masts. The method of this pick-up is unique, although by no means difficult in procedure. A rope of the usual clothes-line variety is suspended from the craft and a weight attached to the floating end keeps it in a more or less stationary position. By flying low, the rope from the airplane intersects the rope between the poles, and the weight intervenes to prevent it from slipping. The rescue rope, released from the poles, is then carried seaward to a point within reach of the distressed vessel.

The pick-up line, once caught in the rigging of the disabled ship, or otherwise secured on board, performs the function of trailing aboard a larger line to which is attached the end of a hawser. To the latter is attached a "breeches buoy," the life preserver and canvas trousers employed in the time-honored method of rescue. This buoy,



PICKING UP THE LINE

A light line, exaggerated in our illustration for the sake of clarity, is stretched between two poles and held by means of

spring clips. It is picked up by a freely swinging weighted line which is seen suspended from the fuselage of the plane

for the rest of his days, should be saved by aircraft. Various methods have been practiced for rescuing ships in distress, but those of the old school most frequently refer to the "cannon." Briefly, this system made use of a miniature cannon, from which was shot a projectile, with life-line at-

line is led through clips to the tops of two slender masts, which are planted on the shore, spaced about 200 feet apart, and landmarked by fluttering pennants.

Immediately upon intercepting distress signals by means of the radio equipment aboard, the airplane takes

with simple tackle, is detailed on its life-saving errand, bringing the crew and passengers safely ashore.

That the airplane is quicker and more certain than the old method, is attested by the fact that in a recent demonstration, 27 life-lines were shot from a miniature cannon mounted on



THE WEIGHTED PICK-UP LINE

The aviator in here shown adjusting the releasing mechanism

a Coast Guard cutter, before contact was established with a ship on the rocks. Then, too, the record distance covered by a line ejected from such a contraption is 695 yards, while the new method of delivery is said to be capable of carrying a rescue line a mile or more.

Certain limitations, however, attend this new means of extending succor to disabled vessels. For instance, a seaplane cannot take off from rough waters, and should it take off from still waters the chances are it would be too far removed from the wrecked ship to offer the needed assistance. While a land plane in this case might be able to take off from a nearby shore, a forced landing would render it helpless. In recognition of these handicaps, the Coast Guard is using amphibian aircraft at the aviation stations where this method of life-saving has been introduced. This, of course, means that the planes used in carrying rescue lines to disabled ships can take off from either land or water—preferably from the former, owing to the usual high winds encountered near a storm-swept vessel.

ANOTHER possible application of airplane activities as an aid in lessening the hazards of seafaring is suggested as a result of the success of conveying life lines. Menacing icebergs that threaten life and property in the traffic lanes of the North Atlantic Ocean have proved stalwart foes to attempted placements of TNT. The reason for such a slight degree of success in the proposed explosions is due to the difficulty encountered in making a true placement of the dynamite. Now, by means of amphi-

bian planes it should be relatively easy to get a line over the top of an iceberg for the attachment of a high explosive bomb.

Maintaining more than 250 stations, stretching along the 10,000 miles of treacherous coasts, the Coast Guard was authorized under the provisions of the First Deficiency Act of 1926, to maintain and operate five seaplanes for use in performing the duties with which this branch of the service is charged. The five new planes are developments of army and navy aircraft features and are designed to give maximum cruising distance. Arrangements for the construction and operation of these planes were made under the general direction of Lieutenant-Commanders S. S. Yeandle and E. F. Stone, and the army and navy officials extended every possible co-operation. Two types were decided upon—the OL-5 amphibian and the UO-4 seaplane. Three of the former and two of the latter have been constructed.

The OL-5 amphibian planes, which have proved peculiarly adaptable to life-saving work, are equipped with inverted Liberty engines; gas capacity 140 gallons; estimated cruising radius 500 miles at a cruising speed of 75 knots; speed range 55 to 103 knots; equipped with Lewis ma-

chine-gun; and have weight and space allowance for radio installation. These planes are capable of landing on and taking off from the water and good flying fields. They are of the three-seater type and have a 45-foot wing span. Two amphibians and one seaplane are stationed at Gloucester, Massachusetts, while the other amphibian and seaplane are assigned to Cape May, New Jersey.

PARAMOUNT among the duties of the Coast Guard is life-saving and rescuing seafarers from peril. More than 200 life-saving stations are maintained on the coasts of the Atlantic Ocean and the Gulf of Mexico alone—each manned by a crew of seven to ten men. They are subjected to a rigid course of drills and well-defined duties, which necessitates their keeping long day and night vigils for disasters on gulf or sea. The life-saving apparatus of every Coast Guard station includes a surf boat with air chambers to make it unsinkable; a self-righting and self-bailing boat equipped with gasoline engine, sail and oars; a "breeches-buoy," an iron-covered life car capable of carrying five or six persons at a time, and operated like a breeches buoy; a bronze cannon capable of shooting lines up to 600 yards; a rocket with a coil of rope at its head which is sometimes used instead of the cannon, and which can



WINDING THE LINE

This method of holding the line to be carried out to a ship eliminates any possibility of a troublesome tangle

travel 1000 yards; beach cart; pulmotor; and now an amphibian plane for rescue work.

That the added duty of apprehending rum-smugglers has not decreased the life-and-property saving efficiency of the Coast Guard service is attested by the following statement, made by Lieutenant Commander Stephen S. Yeandle, aide to Commandant F. C. Billard. "The record for the year 1926 in the primary function of the Coast Guard—the preservation of life and property from the perils of the sea—continues to show, most gratifyingly, that the law-enforcement work in connection with the prevention of the smuggling of liquor into the United States from the sea, also calling heavily and increasingly on the service forces, has in nowise been permitted to intrench upon, break down, impede, nor diminish what is undoubtedly the highest form of service it is the duty of the Coast Guard to perform."

COMMANDER YEANDLE'S statement is backed up by the annual report of the United States Coast Guard, which shows that last year alone, 3037 persons were rescued from peril—a higher number than any year since the organization of the present service—in 1915.

Some 4831 instances of assistance were rendered during the year; 2240 of these cases involved saving of life or property or both—termed major as-



LANDING A RESCUED SEAMAN

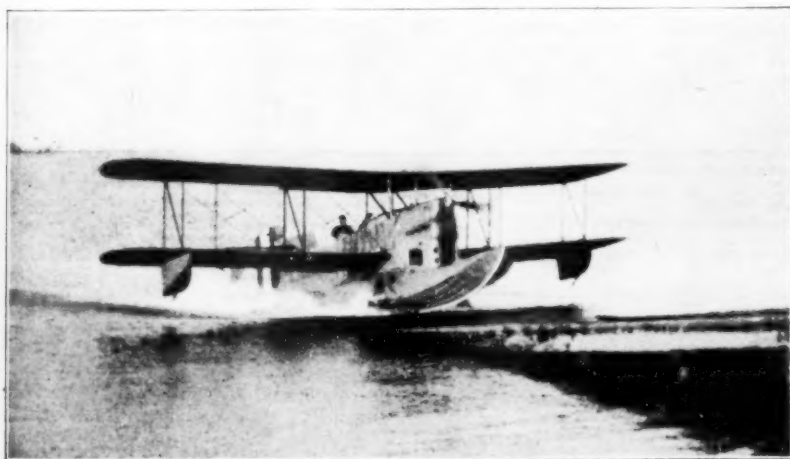
Although a radically new method of carrying out a life-line is employed, rescued persons are still brought to land by means of the time-honored "breeches-buoy"

and other calamitous visitations; dragging the waters for bodies; burial of bodies cast up by the sea; sheltering wayfarers overtaken by storm or other misfortune; preventing theft and invasion by those maliciously inclined; protecting wrecked property; acting as pilots in cases of emergency; co-operating in the enforcement of the Federal laws; et cetera.

After bringing in the unfortunate who has floundered in the waters, the duties

were taken in charge by the crews from the life-saving stations.

The station crew of the Coast Guard is divided into regular watches of two men each, who, during the hours from sunset to sunrise patrol the beach, keeping a sharp lookout seaward at all times. The schedule of watch is: First watch, sunset to 8 P.M.; second watch, 8 P.M. to midnight; third watch, midnight to 4 A.M.; fourth watch, 4 A.M. to sunrise. While the patrolman is out, his watch-mate takes the station watch, which is kept in the tower or on the beach abreast of the station, as conditions may require. If the station is connected with the service telephone line, the station watch makes it his business to be within hearing distance of the bell at regular intervals. In addition to keeping watch seaward, he is on the lookout for signals and telephone calls from the patrolman.



THE AIRPLANE RETURNS

Here is shown the type of seaplane that is employed for the purpose of carrying life-lines. It is riding up on its landing platform under its own power

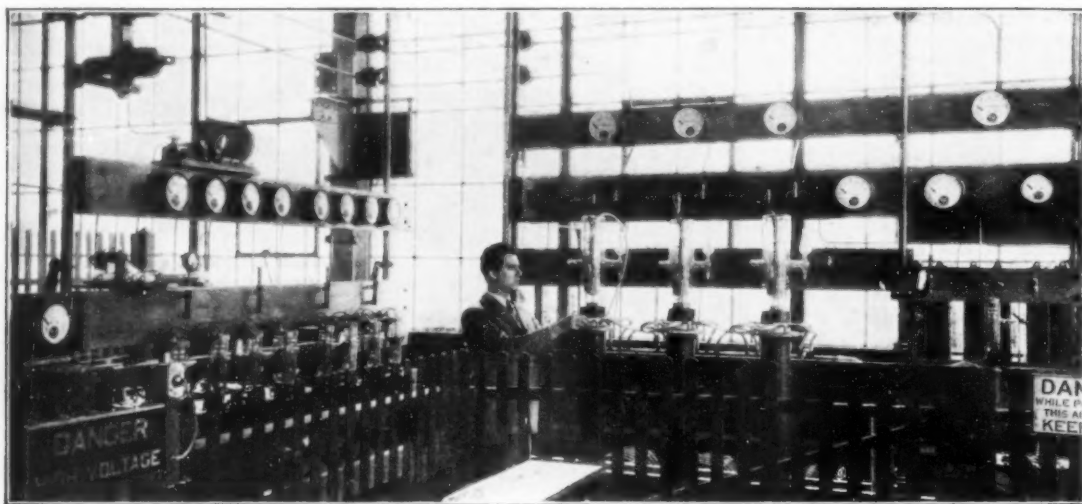
sistance. The remainder of this stupendous figure represented such services as warning vessels standing into danger; furnishing food, fuel, and water to vessels in distress; succoring the shipwrecked; rendering medical and surgical aid to the sick and injured; assisting at neighborhood fires and fires occurring at buildings, wharves, and other structures on the shore line; fighting forest fires; assisting at floods

of the Coast Guard are by no means at an end. Frequently the life-saving crews are called upon to undertake the restoration of persons taken from the water in a helpless or an unconscious condition. Out of 56 cases of resuscitation attempted by the service crews during the year, 25 were successful, the persons being restored to consciousness, and of these 25, at least five were apparently dead when they

EACH patrolman carries a number of red Coston signals with which to warn a vessel standing too close inshore or to notify a vessel in distress that he has gone to summon assistance.

A quite complete system of communication has aided greatly in the work of the Coast Guard. With radio at their service, it is now possible for ships in distress to inform shore stations of their plight, and by means of radio and wire telegraph systems on land, the nearest life-saving station to the scene of the disaster can be reached. These fast means of communication have robbed the hungry ocean of many of its terrors.

And the time has now arrived when the master of a disabled ship may look forward to assistance and rescue by means of a life-line thrown from that messenger of progress and annihilator of distance—the airplane.



WHERE THE MODULATION IS ACCOMPLISHED

In this photograph is illustrated the apparatus and the tubes that comprise the modulation section of the transmitter. From this

point the fluctuating sound currents are sent to the high-power oscillator vacuum tubes which generate the radio carrier wave

The Giant of Broadcasting

Powerful Transmitter With Many New Features Wins Approval of Radio Listeners

By ORRIN E. DUNLAP, Jr.

RADIO records are being shattered by the most powerful broadcaster in the world, nestled in the Mohawk Valley midst the foothills of the Adirondacks. This stentor of the ether is now hurling broadcasts into the emptiness of space with a force of 100 kilowatts or 100,000 watts, sanctioned by the Federal Radio Commission. It was only a few years ago that 500 watts represented a powerful transmitter.

The giant introduces numerous features new to the science of radio broadcasting, including five of the 100-kilowatt tubes that have made possible this advance in ethereal communication. So powerful is the installation that 60 gallons of water per minute are required to cool the tubes of the transmitter, lest they melt. A tiny quartz wafer keeps the powerful wave from wandering off its assigned channel, while automatic protective devices shut off the power in case of tube failure and warning is given should the water supply fail. The initial test is recorded in radio history as the first time that 100 kilowatts of power were modulated and put on the aerial for broadcast service.

THE transmitter is located on a 54-acre plot at South Schenectady where facilities are available for various arrangements of aerials, counterpoise systems, and for power and cool-

ing requirements for a large number of transmitters operating simultaneously on a wide variety of wavelengths. On this radio reservation there are four steel aerial towers, three of which run aloft for 300 feet and another 150 feet high. In addition there are a large number of shorter masts. There is a rectifier capable of supplying 750 kilowatts of direct current at 15,000 volts.

The development of this installation was hastened by the production of the



MARTIN P. RICE

Mr. Rice is director of broadcasting for the General Electric Company, and is an enthusiastic advocate of high-power radio transmission for the attaining of reliable public radio broadcast service

100-kilowatt power tube by the research department of the General Electric Company. The new transmitter occupies less than half the space taken by the 50-kilowatt apparatus, heretofore the highest powered equipment. Two of the 100-kilowatt tubes are utilized in the amplifier unit, and three others function in the modulator unit. The 50-kilowatt transmitter, operated at 30 kilowatts, in accordance with the Federal license, uses seven 20-kilowatt tubes in the amplifier and 12 tubes of the same size for modulators.

THE 100-kilowatt transmitter consists essentially of a radio power-amplifier, the frequency of which is controlled by a quartz crystal, and a modulator bank together with other necessary apparatus. Two 100-kilowatt tubes of the conventional metal-anode construction are employed in the power-amplifier unit. The anode is copper, approximately three feet long by three and one-quarter inches in diameter. The filament and grid leads are brought out through the top of a glass cylinder which is about 19 inches long by five inches in diameter. The tube is 50 inches long.

For filament excitation the tube requires 210 amperes at 35 volts. Two of the tubes, used in parallel for normal operation, work into a tank circuit which is inductively coupled to the

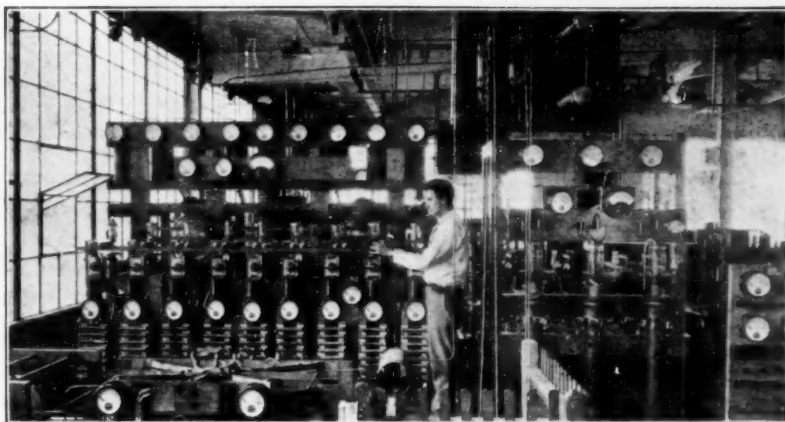
aerial by means of coupling coils and a transmission line.

The aerial is of the vertical type, consisting of a cage two feet in diameter and 240 feet high. The wires are combined to form a single conductor for the lower part of the aerial. A counterpoise, consisting of a radial wire system 240 feet in diameter, is employed instead of a ground connection.

The frequency of the transmitter is controlled by a quartz crystal so that the powerful waves do not get off the assigned channel. The output of the crystal is amplified by five stages of radio-frequency amplification to a powersufficient to completely excite the grids of the 100-kilowatt tubes in the power stage. All amplifier stages are completely neutralized so that there is little possibility of independent oscillations in the amplifier chain. Thus the quartz crystal determines the radio or carrier frequency of the transmitter, which is 790 kilocycles, the same as used by station WGY in its regular broadcasts.

SPEECH or music to be radiated is sent from the WGY studio over a telephone line, at a power approximately equal to that used for ordinary telephone conversations. This voltage is then amplified 1000 times by an audio-frequency amplifier chain, the last stage of which utilizes a 20-kilowatt water-cooled tube. It is then impressed on the grids of three 100-kilowatt tubes used as modulators. These tubes function directly in the plate circuit of the power-amplifier tubes and vary the plate potential in accordance with the speech frequency which actuates the microphone.

Power for the plate circuit of the transmitter is obtained from a rectifier which employs six vacuum tubes of the two-element type. These tubes are of the same size as those employed in the transmitter but have no grid



THE GIANT AT SCHENECTADY

At the left is the 50-kilowatt transmitter compared with the large yet more simple 100-watt installation which may be seen directly in back of the operator

structure. This rectifier is capable of supplying 750 kilowatts of direct current at 15,000 volts. Several large filter units eliminate all objectionable 60-cycle ripple from the output. Power for the rectifier is taken directly from the 13,200 volt, three-phase supply for the station. A motor-operated voltage regulator enables the operator to vary the output voltage at will, under load. So efficient is this rectifier that it is capable of supplying a transmitter having an output of 250 kilowatts. Although such a transmitter is not available at the present time for broadcasting purposes, it is considered to be practical.

IN order to keep the anodes of the large tubes properly cooled, it is necessary to circulate 12 gallons of water per minute through the water jacket in which each tube is mounted. For the transmitter proper, exclusive of the rectifier, a flow of 60 gallons of water per minute is required. This is obtained from a centrifugal pump which obtains its supply from a cistern of 20,000 gallons capacity. On its return from the tubes, the water flows through a radiator in which it is cooled by a current of air supplied by a large blower. The water is then returned to the reservoir. This type of cooling method is termed a closed system because it is not dependent upon an actual contact between the water and air for removing the heat from the water. The water is protected from dust and other impurities so that it may be used for long periods without replenishment.

The engineers call attention to the interesting fact that the cooling water

actually comes in contact with the plates of the tubes, which are at high radio and direct-current potential. It is well known that pure water is a fairly good insulator. By using a long rubber hose between the water connection to the tube jacket and the supply pipe it is possible to secure sufficiently high resistance in the column of water to prevent excessive loss of power caused by conductance of the water.

Remote-controlled electrical apparatus and protective devices make the operation of the giant transmitter quite simple. The operator has before him two major controls. One switch regulates a small rectifier which supplies the plate circuit of a small metal tube designed to supply the excitation for the main power-amplifier. A second switch controls the large rectifier which supplies the plate circuit of the main radio power-amplifier tubes and the plate circuit of the modulators. In preparing the installation to go on the air, all motor-generator equipment, including the water-cooling system and blowers, rectifiers and low-power amplifiers both audio and radio, are started. The set is finally put on the air by the use of two major control switches which, at the will of the operator, send 100 kilowatts of radio-frequency energy into the aerial. The operator constantly checks the degree of modulation by means of an oscillograph while the quality of the broadcasts is checked by a loudspeaker.

PRELIMINARY test programs have brought an unexpected volume of letters and telegraphic reports from radio auditors. The engineers are especially pleased with the unanimous endorsement of the high power and the enthusiastic applause for the tonal quality and volume of the signal as well as the sharpness of tuning.

An analysis of the letters received at the conclusion of early morning tests



RADIO STRIDES ONWARD

The new high-power transmitter at WGY established a new record when 100 kilowatts were successfully modulated. One of the big tubes is a spare

indicates that the signal strength over the area east of the Mississippi River and north of North Carolina is equal to that of broadcasters operating



THE BIG TUBE

This is the type of vacuum tube that hastened the development of super-power broadcasting. Note the water jacket

within 50 miles of the receiver. In mid-summer, the high-power installation was heard with good volume and clarity in parts of the country not reached by the regular 30-kilowatt transmitter after spring arrived. Listeners reported that the signal strength is so great that static, even during severe electrical storms, was completely over-ridden and the broadcasts could be appreciated for the musical quality. Many of the more distant auditors reported that fading was less frequent and less pronounced but the letters indicated that fading is not appreciably improved by high power within a radius of 300 miles, where WGY's normal transmissions wax and wane. The observers said that modulation is excellent and the quality of the reproduced signal above the average.

There is no doubt in the minds of the station officials who made a survey of the mail that the 100-kilowatt signal tunes sharply. Those with sensitive receivers were able in many cases to tune out WGY and tune in more distant stations whose frequency was separated only 20 kilocycles from WGY's frequency.

ONLY one correspondent pronounced the test a failure. This resident of Newburyport, Massachusetts, said, "There never was a high-power station that was not a failure. You cannot expect a balloon to keep from bursting when you give it too much gas. What becomes of a radio wave if blown apart?"

The president of a radio set manufacturing company said, "Modulation, we believe, was perfect; sharpness of tone both in voice and music was extremely fine. As far as we could make

out by ear, this was the clearest and in every respect the best broadcast which we have ever had the pleasure of tuning-in."

A prominent engineer of the radio division of the Department of Commerce summarized a technical report on reception as follows: "It is my opinion that the efficiency of your station so far as the delivery of reliable signals to broadcast listeners is concerned, has been increased 100 percent. This holds for coverage and for quality."

A listener in Virginia reported that lightning was so severe that the street lights in parts of the city were out of commission, but that the storm had no effect upon the music radiated from the 100-kilowatt transmitter. A Pennsylvanian said that he disconnected the aerial and ground and then tuned in the signals as strong as those of a Chicago station, which he had tuned in a few minutes earlier with "everything I had."

FROM Wisconsin came the message that "WGY came in so loud that we were able to tune all the static out and get the music as clear as a bell." A listener in Minnesota said, "This is the first time that I have had any eastern station since last spring," while another report from that region said, "Your volume exceeded that of a station 80 miles away. There was no fading. Tonal quality was good and the signals tuned sharply."

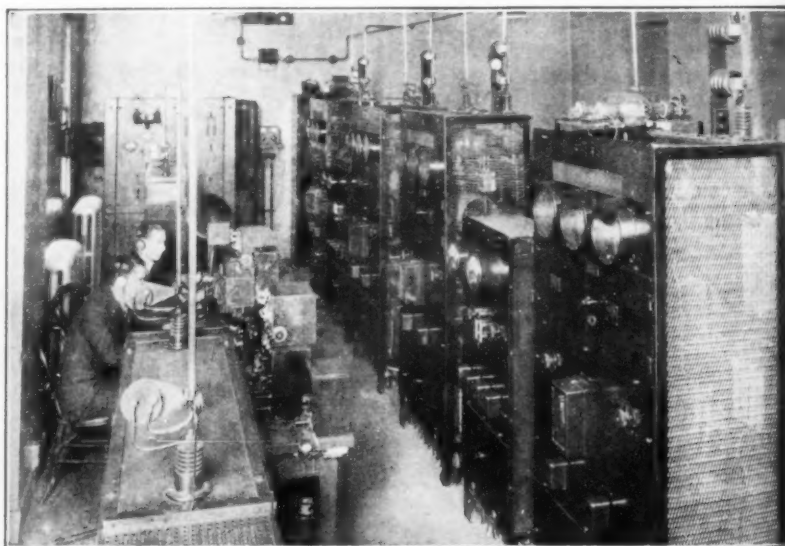
The new station is apparently an

to tune off my set because of nerve-racking static but I came across WGY with a signal so clear that static was hardly noticeable and I had to reduce the volume."

A St. Louis enthusiast reported, "Best program I have ever had on my set from any station close or far, cold weather or hot."

IT is expected that the WGY transmitter will be "King of the Air" as far as power output is concerned for some time to come. High-power broadcasting installations are expensive. The cost of WEA's 50-kilowatt outfit is placed at half a million dollars. This does not include the thousands of dollars spent in the development work at South Schenectady before the transmitter was built for installation on Long Island. There are not many broadcasters in the field today who can afford to spend 500,000 dollars on an installation which within five or ten years may be ready for the archives of the past.

Nevertheless, high power insures improved public service and tends for fewer stations, both of which are sorely needed in the broadcasting realm of the United States at the present time. Perhaps some day the research engineers will learn how to successfully modulate a short-wave station with an output of 100 or 500 kilowatts and such a station might go a long way in serving the wants of the world as far as reliable reception is concerned. There is no doubt that



THE TRANSMITTER AT WJZ

A section of the Bound Brook installation. Note the difference in this outfit compared with WGY's equipment. WJZ is now rated at a power output of 50 kilowatts

enemy of static. An observer in Arkansas said, "Although we had a lot of static, WGY was so strong that it knocked the static out completely." A Wisconsin man said, "I was about

progress in broadcasting will depend a great deal upon high power. That is why the Federal Radio Commission is beginning to look with favor upon this type of transmission.



Great Britain's Mechanised Army

All photographs by P and A



READY FOR ACTION

Armored cars hauling gun carriages, taking the place of horses. The men of the crew are equipped with gas masks



THE OLD AND THE NEW

Several of the newly developed British mechanical "horses" passing in review before an obsolete horse-drawn battery

IT is a far cry from the lumbering, slow, clumsy tanks that were first used in about the middle of the World War, and which were used with such telling effect, especially on the morale of the enemy, to the present-day mechanical vehicles that are a part of every modern army.

Especially is this true when the present variety of tanks is considered. They range in size from tiny "tankettes" to full size vehicles and they carry armament consisting of pieces varying from machine guns to field artillery. And no longer are tanks

limited to fighting—they now take the place of horses in many phases of warfare, and they fill the requirements to much greater satisfaction. While they have their own peculiar troubles, they are found to be more efficient in many ways than horses.

THEY are employed for transporting troops and also for towing units of artillery into the battle lines. In recent war maneuvers held in England, the "British Mechanised Army" as the highly developed tank corps has been termed, demonstrated

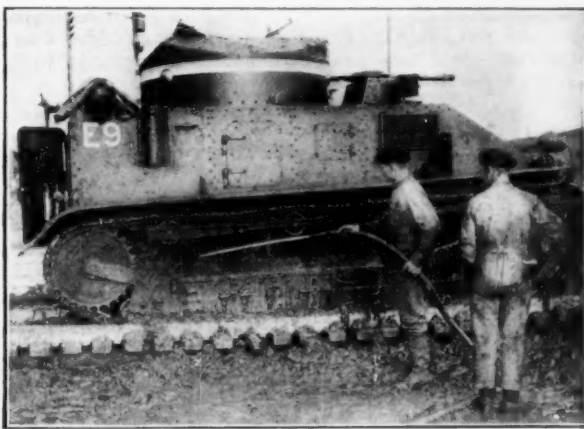
its superiority over the horse. In a series of tests, the caterpillar equipped transport vehicles developed speeds of up to 35 miles per hour, thus showing that by their use, the movements of troops, supplies and artillery can be speeded up to a great extent.

As we have illustrated on our cover this month, radio is often a part of the tank equipment. By the use of this communication system, the various units of a corps can be kept in constant touch with each other and thus always in co-ordination. Directions can also be obtained by radio.



THROUGH THE MUD

A battery of tanks in a mimic attack in which they demonstrated their adaptability to many adverse conditions



"CURRYING" A MECHANICAL STEED

Instead of the old curry comb and brush, the modern member of the mechanised army makes use of water and a hose

How Nature Conquers

When One Watches Closely the Reforestation of a Barren Area, Some Surprising Routines of Nature are Revealed

By H. J. LUTZ

Formerly Technical Assistant, United States Forest Service; Member, Society of American Foresters; Ecological Society of America

What is "Ecology?"

ONE of the most interesting corners of science is that of ecology, "the science of the relations of the organism to its environment, organic and inorganic." When we start out, as in the accompanying article, to see whether there is any system in Nature's rehabilitation of a waste area, we discover that, apparently, system permeates it all. But is this a purposive system? The evidence, killing romance, says "No." Natural forces—fortuitous circumstances, cause and effect, survival of the fittest—these alone, and not a conscious Nature, control it.

The Editor

NOT so many years ago, as geologists figure time, vast portions of southwestern Alaska were locked securely beneath great sheets of ice. It is only in comparatively recent times that these immense blankets have shrunk to the remnants we see today. By referring to the present day ice-fields as "remnants" it is not, however, intended to imply that they are insignificant, for they certainly are not. Yet they do represent only the skeletons of the far more extensive fields which existed in past ages.

As the ice of a glacier melts back, year after year, it deposits in front of it extensive moraines of glacial debris. These, of course, are at first totally devoid of plant life. Besides these barren moraines there are the bare rocky flanks of the valley which are often polished smooth, with all loose rock and soil swept away. These uninhabited areas are new worlds for

Nature to conquer. She is challenged to the work of reclaiming these barren fields, a truly great task, yet one of which she has many times proved herself fully capable.

As glaciers of the present day recede, an excellent opportunity is afforded to see just how Nature regenerates such areas; how she musters her forces, and under just what conditions she wages her battle.

As a glacier retreats—that is, melts back, for no glacier ever actually moves bodily backward—it drops its burden of rock flour, gravel, and other debris that it has carried so far in its icy grasp. The raw, rocky soil, totally devoid of any organic matter, and practically sterile as to bacterial life, presents a cold, inhospitable place for any plant growth. Moreover, the newly formed land features are not stable, and continual slumping and rapid erosion take place. Besides these adverse conditions, blighting winds sweep down off the ice with terrific force. In places these winds alone are so severe as to prevent any arboreal growth.

However, Nature, with all her fortitude, has developed plants which can exist, yes, even thrive, under just such conditions. One may well expect the earliest invaders on these frontiers to be sturdy pioneers that gain and hold a place for themselves in the face of great odds. One can also expect these first plants to be herbaceous perennials, for such plants have an immense

advantage over the trees because they are smaller of stature and spend the winter in a dormant, or nearly dormant, state. Then, too, even if these small plants do suffer heavily from frost or other injury they can soon regain any ground they lose, since they are such



THE FIRST STAGE OF REHABILITATION

For a long time the rocky flanks will support only little particles of moss or at most, scattered shrubs

prolific seeders, multiplying rapidly. On the other hand, the trees may live and thrive for many years and then fall the victim of one exceptional season and, due to their relatively more scanty and less frequent seed production, they may find re-establishment more difficult and slow.

The first plant which is found to come in after a glacier has done its devastating work is a small brown moss that seems to possess unusual hardness for so diminutive a plant. It grows here and there in little patches over the rock-strewn moraine, even within a couple of hundred feet from



THE SECOND STAGE OF REHABILITATION

A patch of lupine has become established on an otherwise sombre landscape, forming a close, compact community of small plants



A TYPICAL OUTWARD MORaine

The broad flat is composed of glacial debris. It is too unstable to support very much vegetation, except in small patches here and there



A CASE OF GENUINE FRIENDSHIP

Little spruce trees "seek" shelter from the wind behind protecting boulders—this at least is the emotional way to regard it



THE FOREST VANGUARD APPROACHES

Only a short distance from the glacier, owing to existing local conditions, little groups of Sitka spruce have begun to spring up

the ice front. Since the yellowish brown patches blend in with the drab color of the ground, one does not at once sense the importance of these little plants. However, they are an essential part of Nature's plan for colonization, preparing as they do, the way for the succeeding stages of plant life.

This moss is soon followed by a somewhat higher step in the scale of development, characterized by a beautiful, showy lupine. The lupine grows luxuriantly, and forms dense patches which would rival the beauty of any cultivated flower garden. Each of the long stalks bears great numbers of dark, purplish red flowers, making royal splashes of color on the otherwise somber landscape. I have noticed single stalks with over 130 seed pods, each pod containing from eight to nine seeds. Since single plants commonly have 50 to 60 stalks, the tremendous seeding ability of this plant becomes at once apparent.

When the lupine has stabilized the fresh, raw soil, and has added organic matter, we find that it, too, is replaced by a third and still higher stage of plant growth. It is at this point that willow, alder, and black cottonwood seedlings make their appearance, along with scattered invaders of Sitka spruce and hemlock. The spruce

and hemlock seedlings, especially, show unmistakable evidence of their severe battle with the elements.

They cling close to the ground, forming grotesque little figures here and there, or else they seek shelter from the terrible winds behind mounds of earth, or kindly rocks—anything, in fact, which offers protection.

The constant gales which sweep down off the glaciers greatly retard the establishment and advance of plant life in these new places. So severe are these winds that the upper slopes facing the ice front, as well as the ridge tops, are often totally devoid of any growth. Since the leeward slopes are not so much affected by these winds, they support a luxuriant growth of vegetation when the exposed slopes are still quite bare. This difference in rate of advance results in a distinct zonation of the vegetation.

THE uneven battle these trees wage with the elements renders their growth unbelievably slow. Little spruce trees four inches high often show ages of 40 to 50 years. Instead of appearing as normal trees, many of them are low, almost prostrate, bushes.

Some of the trees in exposed places show the severe scouring effect of wind-driven snow and have their bark eaten away and smoothed by it on the windward side, leaving long patches of dead wood exposed. In one place the writer was astonished to find trees 12 inches or more in diameter which had been snapped off by the wind as though they were straws.

This damage goes on each year, but as the trees are injured they rally and try to send out a new leader which in time may become the main trunk. Sometimes several new leaders start at the same time and thus the tree takes on a dwarfed, bushy appearance, becoming "bayonet-topped."

Sooner or later, due to their longer life and ability to endure shade, these fourth stage invaders, the spruce and hemlock trees, are able to overtop the willows, alders, and cottonwoods,

and once this is done they make much more rapid growth. Yet even when they accomplish this, the struggle between the trees for light and water continues to be just as keen as ever, and many of the poorer and less adaptable individuals are killed while they are still young. The more hardy ones continue to develop and grow and finally form a mature forest on the moraine which some 200-odd years ago was locked in the icy embrace of the glacier. Thus, fully developed



THE CLIMAX FOREST

A forest of fine large Sitka spruce on a glacial flat at King's Bay. Final stage

stands of spruce and hemlock are sometimes found within 1000 feet of the ice front.

The plants represented in each stage of such a succession as the one just outlined are the best adapted ones available for the colonization at that particular time. As the plant communities become higher in the scale of development they become more complex, and competition increases until it finally becomes so keen that only the fittest are able to survive.

Because of this survival of the fittest, working over long periods of time, there are few imperfections in Nature's final expression of vegetation—the climax forest.



CONQUEST OF THE CONIFERS

The spruce and hemlocks have over-topped the alders and willows, and conquered

The Stars of the Manger

Ten Co-operating Astronomical Observatories Have Revealed that the Little Cluster Known as Praesepe—"The Manger"—Contains Over 350 Stars Traveling Side by Side Through Interstellar Space

By HENRY NORRIS RUSSELL, Ph.D.

Chairman of the Department of Astronomy and Director of the Observatory at Princeton University
Research Associate of the Mt. Wilson Observatory of the Carnegie Institution of Washington

THE astronomers of antiquity were remarkably good observers; there is very little in the heavens which the unaided eye can see well enough for real study which they did not note.

In the constellation "Cancer," for example, among its rather inconspicuous stars there appears a little diffuse patch of light which is easy to see only on a clear, dark night, but under good conditions is always found to be there, a permanent feature of the heavens. They called it in Roman days "Praesepe"—the manger, while two little stars nearby were the "Aselli," the donkeys who fed upon its contents.

"Praesepe" is in the heavens still, in the same old place, and it looks to the eye the same as ever. But, even an opera glass shows what it really is—a cluster of stars of which the brightest are just too faint to be visible separately without optical aid. Were any one of them by itself we could not detect it at all without such assistance; but there are so many of these faint stars within a small area that their combined light is about a quarter that of the Pole-star. Though we cannot see the separate stars the cluster appears therefore as a hazy spot of light.

THE brighter of these telescopic stars have long ago been carefully observed and catalogued, and a century's observations show that they are moving in the heavens, and as might be expected, moving together toward the east and south at the rate of one degree in 100,000 years. Slow as this motion is, the observations suffice to define its amount pretty accurately, and to detect with certainty the few stars which do not belong to this cluster, but lie in line with it and in front or behind. The chance that such an unrelated star should happen to be

moving in the same direction as the cluster and at apparently the same rate is obviously very small. All other interlopers can be picked out at once by their discordant motions.

These proper-motion observations, however, are limited to a dozen or so of the brightest stars of the group. To search for fainter ones recourse may best be had to photography. An interesting investigation by this means has recently been made by Dr. Klein Wassink of the Kapteyn Laboratory

plates were taken and both old and new ones sent to Groningen to be measured. How thoroughly international the study of the heavens is, is well illustrated by the list of the co-operating observatories: Pulkovo in Russia; Greenwich and the Radcliffe Observatory (at Oxford) in England; Stockholm in Sweden; Helsingfors in Finland; Potsdam in Germany, and the Lick, Yerkes, Allegheny and Dearborn Observatories in this country—ten institutions in all, belonging to six different nations. The intervals in date between the earlier and later plates range from nine to 32 years—long enough to disclose the motion clearly.

Upon these various plates the images of about 600 stars were measured and their motions found. The list is fairly complete as far as the thirteenth magnitude; and the Lick plates, though covering but a small part of the whole cluster, go down very much further—to the eighteenth.

WHEN the results had been collected and the various sources of error eliminated (a tedious job) it appeared that the majority of the 600 stars were standing nearly still in the sky or at least moving slowly in all directions at the rate of perhaps a quarter or a half a degree in 100,000 years. Nearly 200 of them, however, were moving faster—a whole degree during the same period, and substantially all of these were going at the same rate and in the same direction.

These latter stars and these alone are evidently the real members of the cluster. The rest, as their small motions show, are mainly "background" stars, far behind the cluster.

All told—and making allowance for the fact that the cluster appears to extend in some directions over a larger area of the sky than the plates cover—it appears that there are in

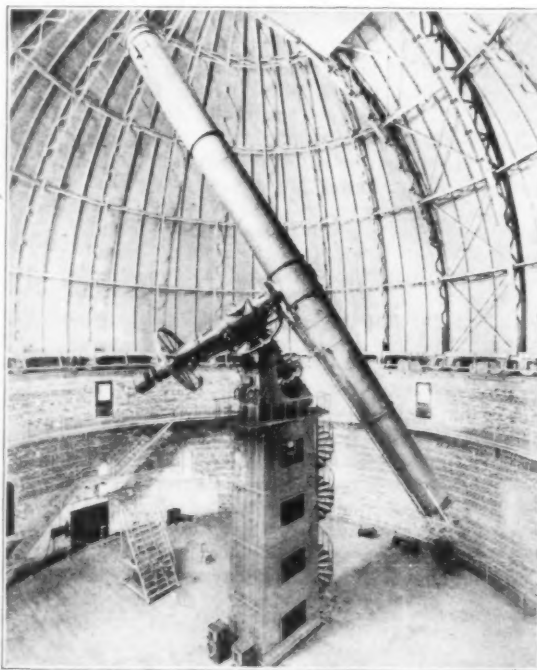


Photo by Yerkes Observatory

THE YERKES REFRACTOR

The main instrument of the Yerkes Observatory is a refracting telescope having an objective lens forty inches in clear aperture

at Groningen, Holland, which now bears the name of its founder and first director.

To determine such small motions with certainty it is necessary to compare plates taken many years ago with recent ones. By the friendly co-operation of several observatories at which photographs of "Praesepe" had been made in past years new

the "Praesepe" group about 80 stars brighter than the tenth magnitude, as many more between the tenth and twelfth, and about as many again between the twelfth and fourteenth. The number of fainter stars is harder to estimate, but it is probable that the whole number down to the eighteenth magnitude is about 358. These stars are scattered over an area of the sky about four degrees in diameter—though the brighter ones which form the group visible to the naked eye are confined within a radius half as great.

SUCH a group of related stars, which we cannot doubt to be of common origin, invite further study. The spectra, for example, of many of the stars have been observed and the same situation is found that exists in many other clusters. Among the brighter members all spectral types except "B" and "M" appear—that is, we find stars of all temperatures except the very hottest and coldest—but the fainter stars of any given brightness are much more similar in color, and on the average are redder, the fainter they are. Here we evidently have the familiar giants and dwarfs, and it is clear that the brightest stars of the cluster must be comparable in reality with the brightest in the "Hyades" cluster (in which a similar situation is found), while those of the eleventh magnitude, which are dwarfs, not far from the solar type spectrally, are doubtless comparable also with the sun in brightness.

If this is true we know both how bright these stars look and how bright they really are, and from the comparison can find their distance, which comes out a little less than four times that of the "Hyades."

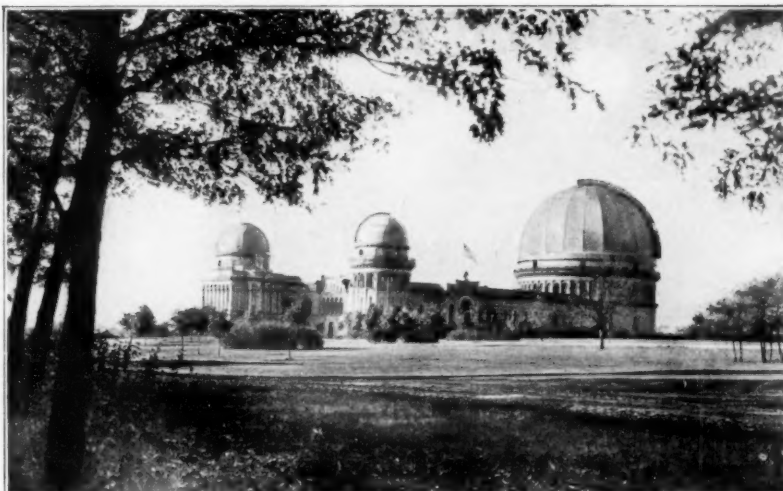


Photo by Yerkes Observatory

THE YERKES OBSERVATORY

Situated at Williams Bay, on the west shore of Lake Michigan, not far north of Chicago, the noted and beautiful Yerkes Observatory is one of the largest and most important of the world

Dr. Klein Wassink, from all the available data, derives for the "Praesepe" a parallax of $0''.0073$, or a distance of 450 light-years (while that of the "Hyades" is 120 light-years). With the distance known, it is found that the bright, central part of the cluster is some ten light-years in diameter—though, of course, no exact limit can be set for so ill-defined a boundary—while the outer stragglers extend through a region more than 30 light-years across. The cluster is therefore very similar in size, as well as in the brightness of its members, to the "Hyades," the difference in appearance of the two to the eye arising from the difference of their distances. The brightest individual stars in "Praesepe" give out from 30 to 50 times as much light as the sun. There are about 100 in the cluster which

are brighter than the sun, and some 20 of these are ten times brighter. The faintest stars which have been found in the cluster must be but feebly luminous—of about the twelfth absolute magnitude and hardly more than one-thousandth as bright as the sun.

Knowing the distance of the cluster, its apparent motion in the sky, and also its radial velocity—which spectroscopic observation give us—it is easy to calculate how fast it is really moving, and toward what direction in space. A remarkable situation then appears—"Praesepe" and the "Hyades" are moving in almost the same direction in space, and at nearly the same rate. As calculated from the data here reported the two lines of motion are inclined but five degrees to one another, and the velocities of motion, referred to the sun, are 41 and 44 kilometers per second. These discrepancies are hardly greater than the uncertainties still remaining in the calculated values, and it appears quite probable that these two great systems are really moving together in space along parallel lines and are truly twin clusters, not alone in size, brightness and motion, but in origin. What that origin may have been we can hardly yet even conjecture, nor is so close a community between the two a matter of certainty. But the evidence in its favor is very impressive.

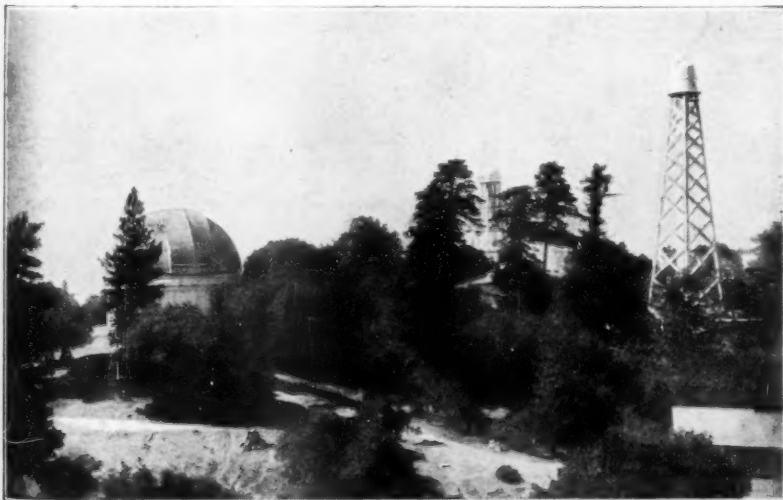


Photo by Mt. Wilson Observatory

TELESCOPES AT MT. WILSON OBSERVATORY

Many and varied astronomical instruments are in constant use at Mt. Wilson. Here the two tower telescopes for solar observations and the massive dome of the 60-inch reflector are shown

WHEN next we look, then, at this shining spot in the winter skies, we may perhaps realize, as we may not have done before, how much that is wonderful, even in our sophisticated age, is revealed by painstaking study of a relatively inconspicuous object which at first glance appears but as a shred of luminous haze.

From the Scrap-book of Science—



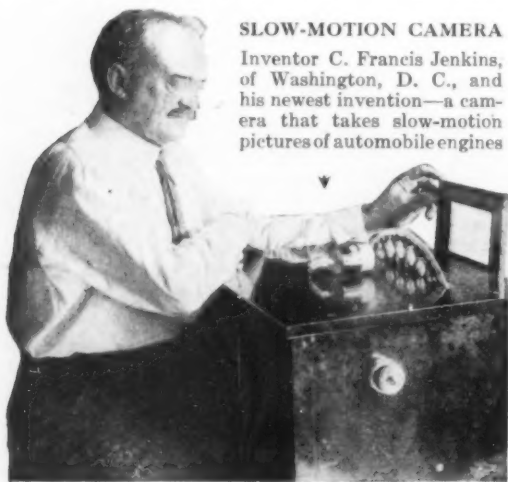
TOKYO—FOUR YEARS AGO

On September 1, 1923, a fire following a tremendous earthquake, nearly wiped out the city of Tokyo. The total loss amounted to more than a billion dollars and was felt by all Japan. Picture shows ruins of the Azuma Bridge



TOKYO—AT THE PRESENT TIME

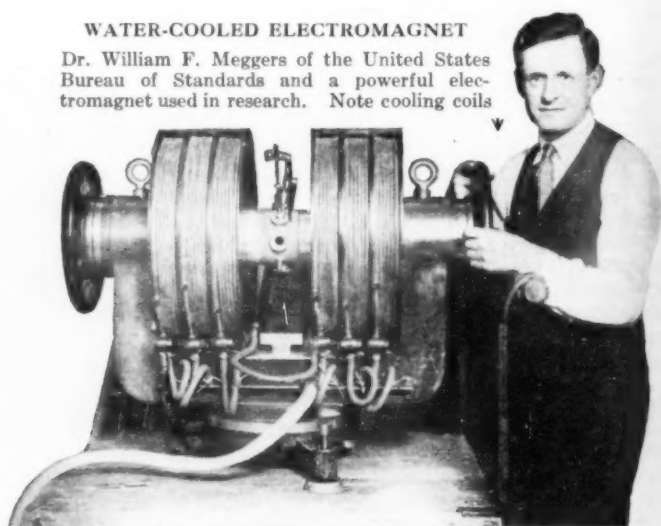
Today the same bridge has been replaced and the city rebuilt, as might have been predicted by anyone knowing the resourcefulness of the Japanese people. New office buildings are designed for withstanding earthquake shocks



SLOW-MOTION CAMERA

Inventor C. Francis Jenkins, of Washington, D. C., and his newest invention—a camera that takes slow-motion pictures of automobile engines

F and A Photo



WATER-COOLED ELECTROMAGNET

Dr. William F. Meggers of the United States Bureau of Standards and a powerful electromagnet used in research. Note cooling coils

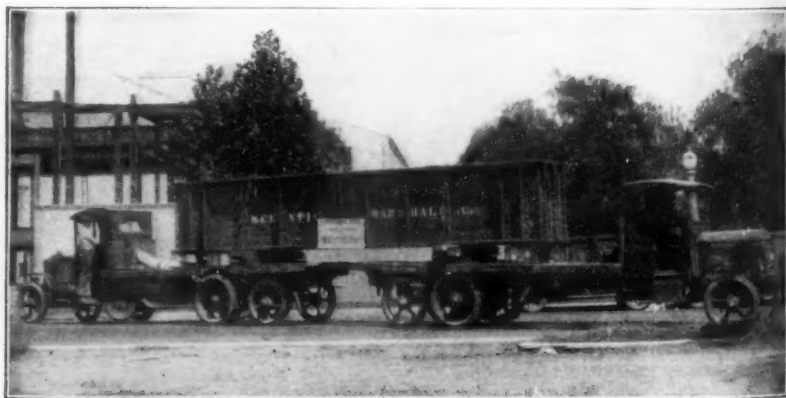
Underwood and Underwood



Herbert Photos

RECORDS OCEAN TEMPERATURE

Steamships are being equipped with automatic thermographs for recording the temperature of the waters of the sea. This instrument, adopted by the University of California, replaces the old bucket tester which recorded only surface temperatures



Herbert Photos

NOT A TUG-OF-WAR

Here is an odd sight recently noted in Los Angeles where the people, accustomed to seeing motion-picture troupes at work, are not surprised at anything. A 25-ton steel girder, too long for one truckload, had to be moved 12 miles. A second truck was assigned to one end of the job—and was driven backward the entire 12 miles! Thus was the heavy, awkward load satisfactorily distributed

Camera Shots of Scientific Events

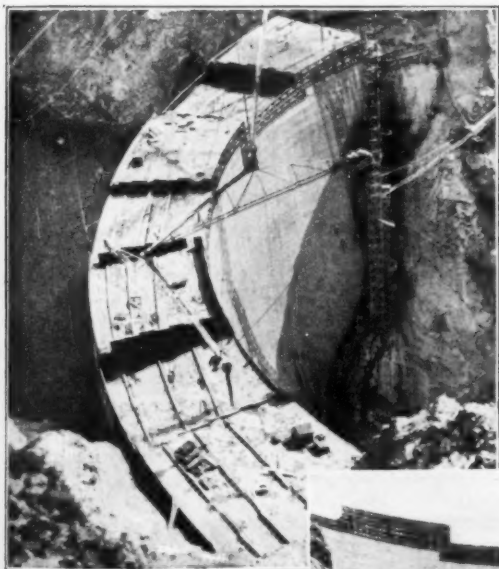


F and A Photo

SCENE AT THE FAMOUS LAKEHURST, NEW JERSEY, AIRPORT

In the air at the extreme left of this unusual panoramic photograph is the Army blimp J-3. Moored to the ground

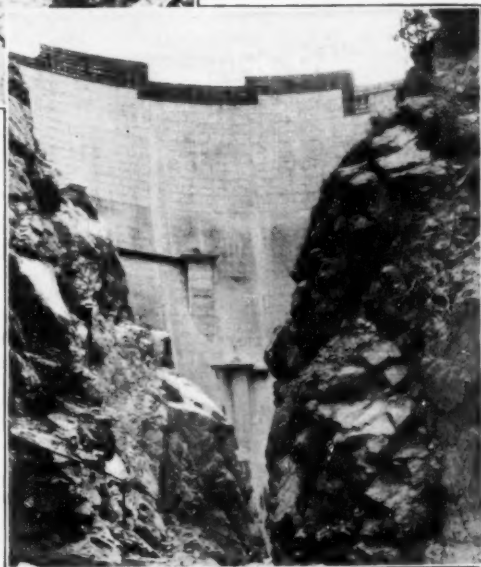
is a dirigible, and to the head of its mooring mast at the right in the picture is the huge well-known *Los Angeles*



International News Reel

LOFTY DAM

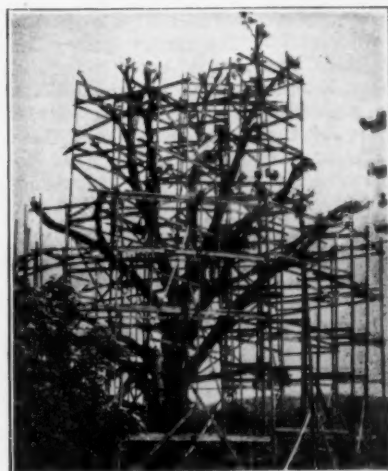
Looking up and down on the Pacima Canyon Dam in the mountains above San Fernando, California. It has just been erected at a cost of over two million dollars, after two years of work. It is one of a series of engineering projects intended to protect the fertile and prosperous San Fernando Valley against floods due to mountain cloudbursts. Its extreme height is 383 feet and it is 600 feet wide across the top. At the base the thickness of the dam is said to be one hundred feet; this tapers toward the top where the edge is only eight feet thick



F and A Photo

WHAT IS RAMIE FIBER?

It is a perennial plant which once furnished clothes for Egyptian kings. George W. Wilson predicts its come-back



F and A Photo

MAMMOTH GRAFT

This enormous black walnut tree will hereafter produce English walnuts



NEW TYPE OF DRAG-LINE

The scoop piles the dirt removed from the canal bed on the banks. This method is fast and does away with the use of trucks



SHAPING THE CANAL BED

By the method illustrated, the bed and side walls of the canal are formed, preparatory to the placing of the steel and the concrete

Water—the Modern Aladdin

Thousands of Acres That Are Now Useless for Agriculture, Will be Made Available for Crop Production by the Opening of the Completed Kittitas Irrigation Project

By CHARLES F. A. MANN

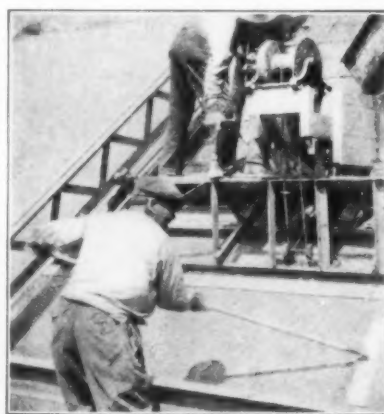
AFTER nearly 40 years of patient effort by citizens of the Kittitas Valley in central eastern Washington, work on the new Kittitas High Line Canal is now under full headway and by 1929 the waters of the Yakima River will be pouring into the Kittitas Valley and will bring some 72,000 acres of almost worthless sagebrush land under intense cultivation. The Kittitas Valley is by far the most economical unit to develop of the entire series of projects in the Yakima Valley and is located on the northern end of one of the most fertile valleys in the United States.

Just east of the center line of the Cascade Mountains three beautiful lakes, Kachess, Keechelus and Cle Elum lie nestled in parallel form in the heart of the Cascades. From their outlets run small rivers which join a few miles away in the valley below and form the headwaters of the Yakima River.

FOR 150 miles this river wends its way through a valley filled with a deep layer of black decomposed volcanic ash and basalt, and travels southeastward in the form of a gigantic figure "S" to the Columbia River at Pasco, near the lower end of the great Columbia Basin. Conditions for growing the finest of crops in the world are perfect here but for the lack of sufficient moisture during July and August.

Few sections of the world are as in-

teresting climatically as the State of Washington. On the western slope of the Olympic Mountains near the seacoast the rainfall averages over 130 inches per year. About 40 miles further inland on the Puget Sound Basin the rainfall averages about 40 inches and on the slopes of the Cascades the heaviest snowfalls in the world are recorded, with a seasonal average running well over 100 feet. A few miles eastward from the lower slopes of the Cascades the rainfall drops back to about nine or ten inches and in the great Columbia Basin, which stretches for 200 miles from the Canadian line to Oregon, the rainfall is scarcely eight



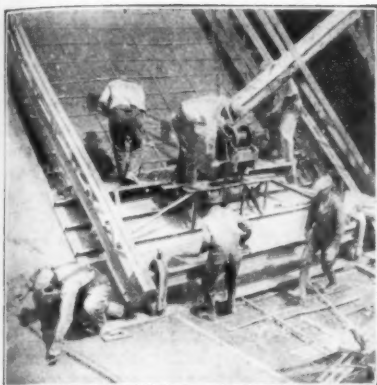
THE CONCRETE LINING

A special movable steel form, the exact shape of the canal, holds the concrete

inches. The average rainfall of the Yakima Valley is about nine inches and entirely insufficient for continuous crops. In fact there is such a wide variation of climate that it is impossible to even find a state flower that will grow in both sections of the state.

In western Washington there is found the densest belt of timber on the American Continent and vegetation is literally drowned with water. The farmer's principal problem is getting his rainfall evenly distributed throughout the year. In the eastern part of the state the problem is getting any water at all on the crops. The soil conditions in the east section are far better than in the west on account of the excessive rock and gravel deposits and irregular land everywhere but in the river valleys, which mark the Puget Sound Basin. Therefore the great problem of the people of eastern Washington is to put more water and then more on this soil and hence the beginning of the great cry for water as early as 1880. There are over 3,200,000 acres of land suitable for irrigation in Washington, of which 1,800,000 are in one solid mass in the Columbia Basin.

WHEN the first government project along the lower Yakima Valley was undertaken in 1903 the Kittitas division of the same project was the next to be completed. A few settlers first caught the vision of an agricultural empire in 1889 and later



PLACING THE CONCRETE

Another view of the lining, showing how the sides and bottom are laid and held

formed the Yakima, Kittitas and Northern Pacific Irrigation Co., to finance the irrigation of the Kittitas Valley. But through influence of residents of Yakima, the Tieton and Sunnyside divisions of the project were built first, and later the Wapato division by the Indian Service for the Yakima Indians, and within a few years the famous Yakima apple began to appear in the world's markets. The total annual crop raised by the three completed divisions of the Yakima project amounts to about fifty million dollars and is raised on about 250,000 acres of land.

In all there are seven divisions of the project, the Sunnyside, Tieton, Roza, Wapato, Moxee, Kennewick, and the Kittitas Basin in the northern end of the valley. There are twelve present and proposed storage reservoirs projected and in operation, all except three being inside the Ranier and the Snoqualmie and Columbia National forests. The total area watered by these divisions when finished will be about 475,000 acres with an annual crop of well over 100,000,000 dollars.

On these projects some 30,000,000 dollars have been spent of private and government money. The most famous of all these projects is the Kittitas division, located in the Kittitas Valley near the base of the east slope of the Cascades and about 130 miles from Seattle and Tacoma. The soil in the valley is fertile and the climate more equable than that found in any other division.

In the center of the valley is located the town of Ellensburg with a population of about 4000 and is the home of the State Normal school as well as the division point of the railroads. Water was first run on sections of this valley near Ellensburg many years ago and as early as 1910 surveys were first run out for a long canal from near the headwaters of the Yakima to bring water into the higher sections of the valley. The entire district was organized as a corporate body in 1911 and empowered to make contracts and settle the land.

CONTRACTS for the sale of five millions of bonds were ready to sign for the purpose of financing the project in 1915 and hopes of completing the project by 1916 were high. A slump in the bond market caused by rumors of war caused the project to be dropped and it was not until 1923 that the government resurveyed the project and announced that work would be resumed. In 1925 the necessary sum of money for the construction of the first half of the main canal from the river at Easton to the head of the main valley was appropriated by Congress and in December 1925 the first contracts were let.

Actual construction on the main canal known as the Kittitas High Line Canal, began in the fall of 1926 and it was not until the summer of 1927 that any progress had been made. The total cost will be about nine million



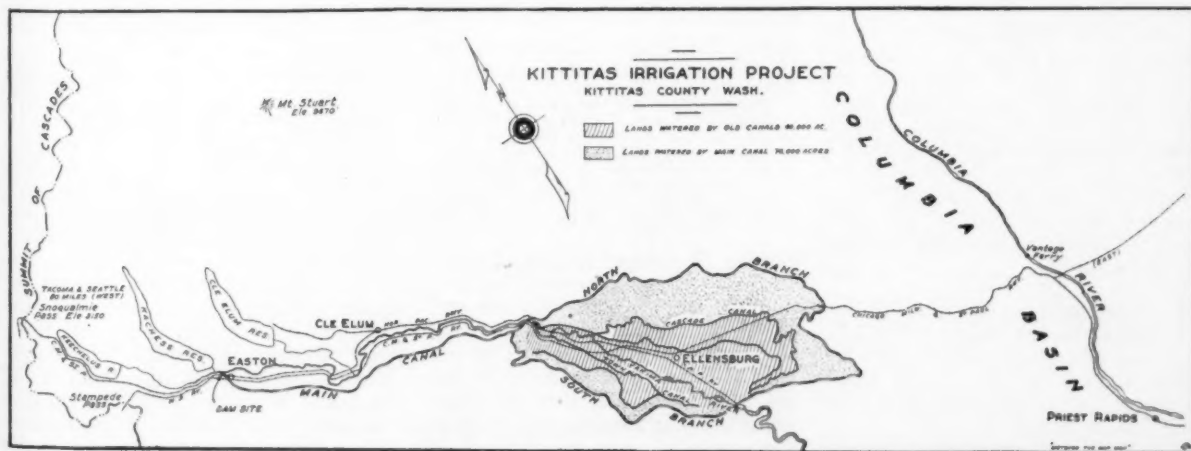
READY FOR THE CONCRETE

The sides and bottom have been prepared, and the reinforcing steel has been placed

dollars and water 72,000 acres, 12,000 acres of which are available for cultivation outside the main valley. At present there are 40,000 acres watered within the valley proper.

Near the headwaters of the Yakima River the three lakes have been dammed across their outlets by earthen and rock walls; Lake Kachess holding 210,000 acre feet and raised 60 feet, Lake Cle Elum will hold 400,000 acre feet when the main dam is finished, and Lake Keechelus holding 152,000 acre feet when raised 70 feet.

These three lakes hold the flood waters released from the hillsides during the spring run off and by means of special automatic flood gates release it into the river during the dry season. Lake Cle Elum will not supply water for the Kittitas Basin, however, as it empties into the river below the diversion dam at Easton. The three lakes are in operation in conjunction with the other Yakima projects further downstream, the Kittitas division paying 1,710,000 dollars for water rights as proportionate cost of the impounding works. The total amount of water will



WHERE THE BENEFIT OF THE KITTITAS IRRIGATION PROJECT WILL BE FELT

The above map details the location of the various canals of the Kittitas system, and shows how a huge section of land will be made

available for the raising of crops. The main canal and its branches will open up to the farmer a total of 70,000 acres formerly worthless

be about 300,000 acre feet per year.

About one half mile above the town of Easton a dam 250 feet long and 65 feet high will soon be built across the Yakima River and from the foot of this dam, which will raise the water 45 feet and flood about 275 acres, begins the main High Line Canal. This canal wends its way along a narrow shelf above the Yakima River for a distance of 26 miles and passes through the richest coal fields west of the Rocky Mountains, the famous Roslyn mines on the east side of the valley.

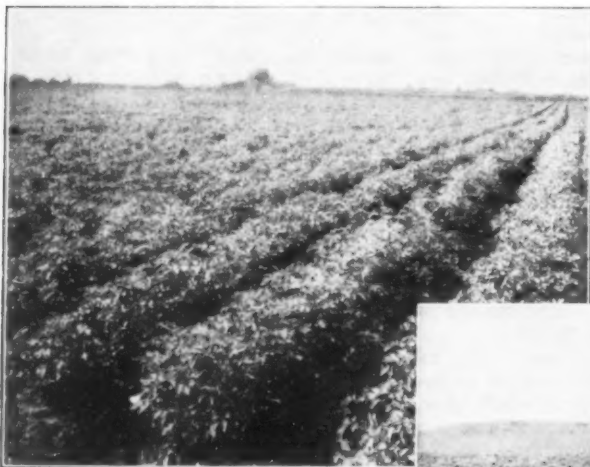
At a point on Thorps prairie near the northern entrance to the main valley the canal divides and two thirds of the

12 feet at the bottom and about 12 feet deep. Enough water will flow through the canal each season to cover Manhattan Island 40 feet deep. The canal will be lined with concrete for about half of its length and will water a large strip of land lying along each side of the canal. A canal known as the Wippel Pump Canal will be supplied by means of a series of centrifugal pumps and will be about 15 miles long and water what is known as Badger Pocket in the extreme eastern section of the valley.

Some conception of the magnitude of this project may be gained by the fact that about eight cubic miles of earth will have to be moved in digging the

right of way and the roads were relocated. Stumps and trees were blasted and the line of the cut staked out. A one ton drag-line of a type seldom used in such work was built and hauled onto the line of the canal. This is operated by a gas engine and scoops the dirt out of the cut from the side and builds up the side walls.

A SPECIAL crew of men next follow the shovel and by means of a special liner made of steel girders molded to fit the shape of the finished canal, smooth off the sides and bottom preparatory to placing the steel matting. This is the most perfect system for measuring the correct angles of the



water is carried across the Yakima canyon and two railroads in a steel syphon over 12 feet in diameter which is carried on concrete piers and nearly 6000 feet long. The other branch goes along the southern rim of the valley for about 14 miles and crosses the Yakima canyon in another syphon about six miles below the town of Ellensburg where it meets the North Branch Canal.

This North Branch Canal starts from the eastern end of the big syphon and follows the northern and eastern rim of the valley for 50 miles until it meets the South Branch Canal. Thus it completely encircles the valley which is shaped like a stomach and all lateral canals will drop gently from the rim to the floor of the valley. There will be about 90 miles of main and 450 miles of lateral canals.

THERE will be six concrete-lined tunnels on the project with a total length of two and one-fourth miles and about 20 syphons with a total length of nearly four miles, the longest being 5400 feet in length.

The main canal will have a capacity of about 1350 feet of water per second and will be a veritable river, having a total width of 45 feet at the top and

walls yet devised. The heavy steel matting is then put in place and the concrete lining poured in place and covered with matting for curing. The unlined sections are of much larger size in order to prevent erosion.

More than 18,000,000 pounds of steel re-enforcing bars will be used in the lining or about seven trainloads. Over 250,000 cubic yards of sand and gravel will be used in the cement mixture, most of which is hauled from a distance of 135 miles from Puget Sound because of the lack of deposits of sufficient size near the project. Approximately 900 carloads of cement or about 16 trainloads will go into the canal as well as 750,000 feet of lumber. A system of laterals will reach every quarter section or 160 acres and the project will be expanded as the settlers move in.

The total cost under the government contracts with the various contracting companies on the project will bring the total charge to about 155 dollars per acre, lower than any other unit of the project. A unique fact will be that no farm will be greater than seven miles distant from a railroad and the cost will be only \$1.40 per acre per year after charging off the cost of putting water on the land.

IRRIGATION RESULTS

Sage-brush land, lower center illustration, is worth about five dollars an acre, but the presence of the sage shows that the land is rich, needing only water to render it fertile for farming. The upper left-hand illustration shows similar land, after water has been on it for two years. A luxuriant crop of potatoes is being raised. The upper right-hand photograph shows an alfalfa crop that was raised on irrigated soil

canals. A typical system of digging the canals is as follows: first, the preliminary surveys were laid out and a topographical map drawn to scale of the entire project so as to assure the exact fall per mile in order to bring the water into the valley at the highest possible level; then, second, main surveys were laid and the right of way marked out.

A crew of men together with a crew of county road engineers cleared the

Successful Inventors—XII

An Industrial Expert Tells Why Manufacturers Must Seek New Inventions to Keep Their Wheels Turning

By MILTON WRIGHT

THE inventor needs to find a manufacturer before he can make money out of his invention. But how about the manufacturer? He has a factory, a product, and a market. Does he need the inventor? If so, how can inventor and manufacturer be brought together to the profit of each?"

We put these questions, and a number of others, to John F. Sherman on one of his flying visits to the New York office of his far-flung industrial engineering organization. Sherman is not an inventor; neither does he represent inventors, but an interesting part of the work of The Sherman Corporation, of which he is president, has to do with adoption of inventions by manufacturing companies.

The quickest way to describe the Sherman organization is to call it a doctor to industries, helping healthy companies stay healthy and grow healthier, and finding for sick companies the causes of their sickness and then working out remedies.

Companies making all sorts of things from agricultural implements to watches seek Sherman's help in solving problems of declining profits, high costs,

technical and mechanical procedures, markets, sales, and so on. Being concerned with what makes the industrial wheels tick and what causes them to slow up and occasionally to stop, Sherman and his staff have probed deep into fundamental causes of industrial conditions. They have found that many companies are suffering from too much plant. Back of this condition may be the fact that they have products which have become obsolete; that need improvements, refurbishing; or, they may need an entirely new product which could be made with existing equipment.

WE had heard of these activities and were prompted to get in touch with Sherman and find out what it is all about and what suggestions might ensue from the interview which would prove helpful to both inventor and manufacturer.

Therefore, to return to one of the questions at the beginning of this article—"Does the manufacturer need the inventor?"

"The inventor has been responsible for much of the phenomenal progress of American industry," said Mr. Sher-

man, "and his importance in the development of industry in the years ahead undoubtedly will be even greater than in the past. The rubber industry, the automobile industry, the motion



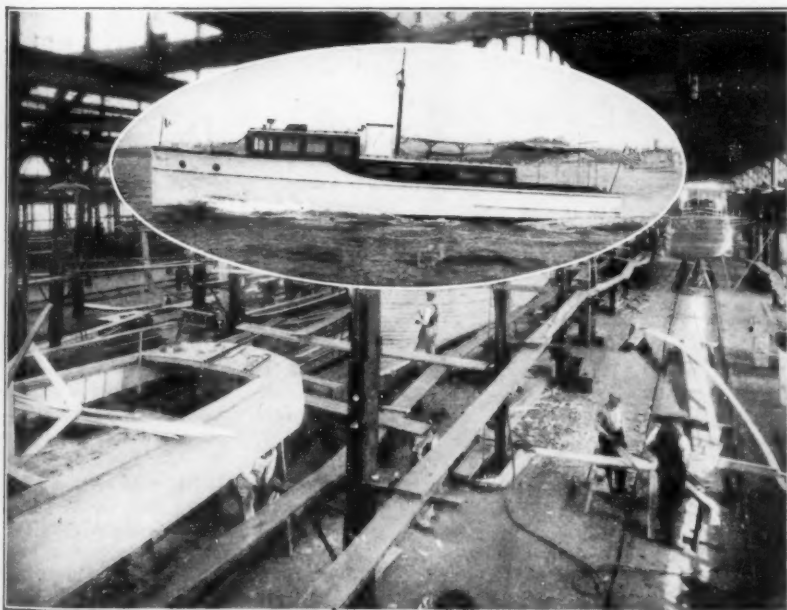
JOHN F. SHERMAN

Industrial doctor who often prescribes inventions to restore industries to prosperity

picture industry—to recall just a few typical ones—are built on the brains of inventors. And it is not alone in the building of new industries that the inventor's contributions are vital, but in keeping old-established industries from dying of dry-rot."

We asked why the inventor is of such importance today any more than in the past.

"Economic pressure," said Mr. Sherman. "Strenuous competition is the order of the day. As one of my associates has phrased it, 'Competition is the death of trade but the life of new ideas.' Markets today are held because the alert manufacturers who are holding them are alive to the need of new ideas and new products. This is true not only in the field of style merchandise but throughout the world of making and selling. Consumers are educated today, through advertising. They rule the roost. The manufacturer who never has anything new to offer kisses goodbye to his customers. Also remember that these problems of market are inter-related with the fact that the country's production facilities are expanded to a point where more and more volume is essential. To solve the complex problems which arise out of the new conditions of today, manufacturers need sound reductions in



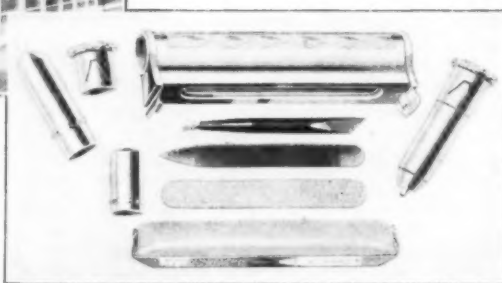
A TOOL COMPANY BUILDS DE LUXE MOTORBOATS

Boat builders turned down the manufacture of the last word in pleasure craft, but an alien industry finds it profitable for itself and the inventor



◀ PENCILS AND MANICURES

Like manufacturers in many other lines, a nationally known manufacturer of a refillable pencil found his plant adaptable to inventions of many other kinds. He has added not only a neat manicure set to be carried in a handbag, but also a shock absorber to increase riding comfort in automobiles



unit costs of manufacture, a broadening of their markets, a one hundred percent utilization of their plant machinery and equipment."

We interrupted. "True enough, but where does the inventor fit into this picture?"

"By supplying the manufacturer with something that will keep the wheels of his factory turning. Ninety percent of American industry today is over-capacitated. During the World War the big problem was one of production, so factories were enlarged and machinery added, in a desperate effort to keep pace with unprecedented consumer demand. You could sell it if you could make it.

IMEDIATELY following the War we found ourselves with a world-wide market and industries were still further expanded to take care of it. Today we have no such world market as we had a few years ago, but our factories have not shrunk. Manufacturers find themselves facing these problems:

"How to utilize over-capacitation of machinery and labor, unused floor space, oversupervision and so on;

"How to level seasonal peaks and valleys by bringing together suitable products and plants equipped to manufacture them;

"How to standardize production, eliminating unnecessary parts and slow-moving items;

"How to stabilize employment, thereby obviating high wages for short-time work and keeping the organization intact.

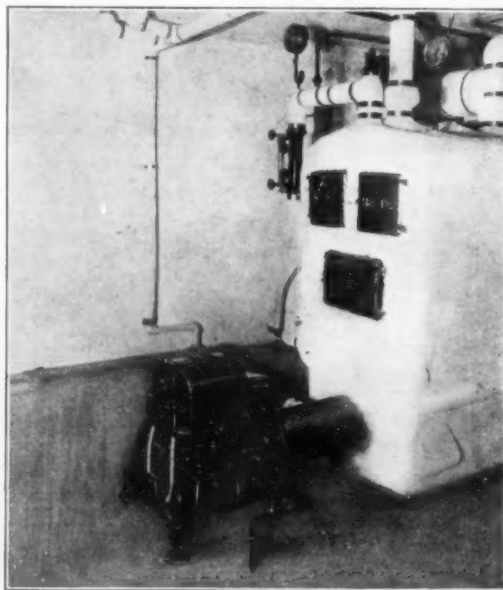
"In all of these activities the inventor plays an important role by providing new products or improved methods of manufacture. The right invention may well be the determining factor in the question of whether a company will go on operating at a loss or turn the corner and show a substantial profit."

"Can you give me," we asked, "any specific examples of an invention saving the day for

a factory that is overcapacitated?"

"I might say that I could give you any number of them, but I don't believe I had better answer that question, without first pointing out some other facts. Will you let me make at this time a distinction between what I will call a raw invention and a new product ready for the market?"

"Our experience with inventors and with manufacturers indicates that there is a tremendous amount of inventive effort going to waste. A great deal of free-lance inventing means that the poor inventor spends a vast amount of time and thought and often hard-earned savings working up some useless gadget that nobody will have.



AXLES AND OIL BURNERS

An oil company had a burner patent. An axle factory had surplus facilities. Co-operation brought profits

"The inventor must realize that the first requisite of any new invention is that there be a possibility of broad human need underlying it, and machinery for its distribution that can be made to turn without spending a small fortune. Let him remember the really outstanding inventions and think of them not as mechanical creations but as things that made it possible for humanity to ride where it had walked; to bridge space with conversation where it formerly required days to transmit messages. Let him remember Gillette's safety razor. The money on this invention has been made not through the razor but the blades. Gillette's fundamental idea from which that invention sprung was that he wanted to get something for which there would be unlimited repeat business. His hitting upon a blade that could be used and thrown

away was a stroke of real genius. "This element of need is the thing that has been fundamental in inventions which have won commercial success. Before he spends a lot of time, therefore, let the inventor check up on the potential market.

THE manufacturer rarely is interested in raw inventions. What he is interested in is something that can be made with his present machinery and for which a market exists or can be developed without too much time and money being spent. In other words, his interest is not so much in new inventions as in new products. To get back to your question, there are any number of examples of how new products have stepped into a manufacturer's picture to add greatly to his profits.

"General Motors is making electric refrigerators. A company that for years made nothing but guns is now manufacturing an electric washing machine. We found a company the other day that used to make only gun-sights and correlary products. Now it is doing a big business in lamps, especially lamp bases.

"A man brought to us not long ago what he called a sedan cruiser. It was the last word in comfort afloat. From stern to stern it had a wealth of novel inventions. Everything you could think of to make cruising a pleasure was on that boat—even to an automatic cocktail shaker in the cabin. The inventor had no factory and no capital. All he had was one boat and a lot of patents.

"In another part of the country was a tool manufacturer. His factory was bigger than his mar-

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ket and he needed a new product to keep his machinery and his men busy all the time. In this instance our organization brought together inventor and manufacturer. We analyzed the potential market for the cruiser. We worked with the manufacturer and helped plan for production on the new product. Today there is a lot of business booked—profitable to both tool manufacturer and inventor."

"But how could one ever arrive at the conclusion that any two persons so widely apart as a motor boat inventor and a tool manufacturer would have anything in common?"

"That, I grant you, is something that calls for a searching analysis of a manufacturer's equipment and methods as well as of a thorough understanding of just what manufacturing facilities are adequate to turn an invention into a commercial product. Many industries are peculiarly adapted to do things they never think of—things that would solve vexing industrial problems.

"Recently an inventor patented an alarm clock attachment for oil-burning furnaces. He and his backers planned a new company to manufacture the product, build a factory and set up machinery. All that, of course, meant enormous expense. One of our clients, however, had a plant that was ideally suited to the manufacture of this article. Furthermore, the plant was twenty percent over-capacitated. A new product to add to the line was badly needed. The oil-burner attachment was added to the line. It rounded out his production and added materially to his profits, not merely on paper, but in actual dollars and cents. The inventor and his backers are delighted, for they get their product manufactured in a plant which is in a position to do the work economically. They also are receiving material help from the manufacturer's sales organization.

"CO-OPERATION is helpful not only between the manufacturer and the inventor, but among various manufacturers. A number of manufacturers in the same line have found that all of them are making substantially the same lines of products and all are working at considerably below their full capacity. The remedy for such an economic waste lies in co-operation. The various companies are combining into an association, allocat-

ing the full production of one commodity to one factory, the full production of another to a second factory and so on, leaving a number of factories free to take on new products which are the creations of inventors.

"As one typical industry which could make use of suitable new products, take the foundry industry. Foundries generally have too much plant and too little new business. Here and there over the country are foundry companies which are 'licking' the situation. They are manufacturing products which require castings. For example, out in Chicago is the Chicago Hardware Foundry Company.

the patent had expired. This meant getting into touch with inventors and having them submit ideas and plans—literally inventing to order."

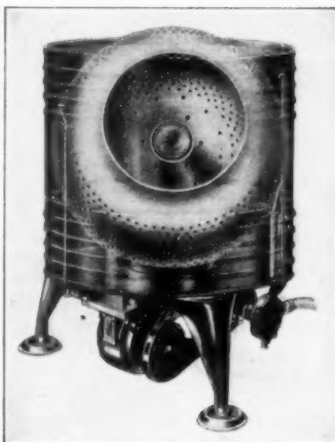
We asked Mr. Sherman what the inventor could get out of such an arrangement on the score of profit.

"THAT'S a question with a lot of dynamite in it," he said. "From what we see of inventors, it is safe to say that most of them have greatly exaggerated ideas as to the fortunes to be made overnight—striking it rich through another Ford car! It's surprising how many things are put up to you as being the 'Ford in its field.' In the foregoing instance, the inventor will not get rich from one invention—the new container. Why should he? The manufacturer makes the market



▲ A GUN FACTORY IN PEACE TIMES

◀ One of the most popular washing machines with American housewives today is made by an outstanding arms manufacturer



They advertise a product called 'Sani-Dry' which, with a turn of a button, sprays warm air over your hands and dries them after washing, cutting out towel ex-

pense and otherwise recommending itself especially to factories, schools and other institutions.

"It is certainly a day when the inventor can come into his own. You know of course, that many of the great industrial organizations have scores of inventors on their staffs, researching—literally inventing to order. I know of a large company which had an oil-burning stove ready years and years before oil burners came into general use. The smaller companies can not do this and yet, if they are to survive, they must get new products and keep pace with other conditions of today's shifting market.

"At the same time that many inventors are letting their brains run wild, so to speak, many manufacturers are looking for some product along definite lines. Recently one of our company's clients had occasion to replace a patented container on which

before the invention is invented. The inventor will be well rewarded for his effort just as an advertising man or anyone else who sells the products of his brain to industry. This is true of many new products. Whereas the inventor is supplying something, the manufacturer also takes great risks. It is true enough that injustices have been done to inventors. On the other hand, think of the millions that have been sunk in inventions that never got across!"

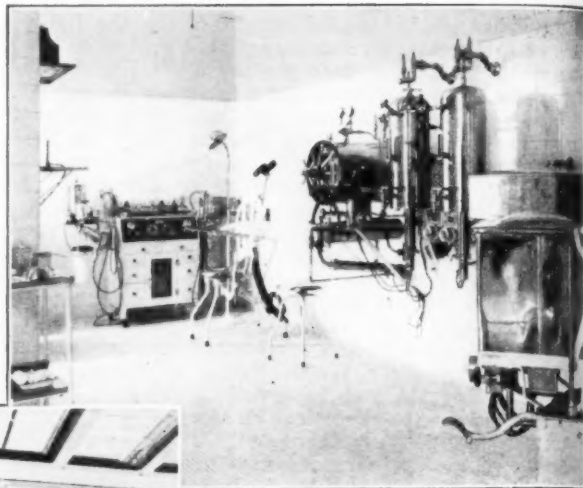
We interposed at this point. "How are manufacturers to know of new products which formerly have not been in their line but which they can produce?"

"Through a thorough analysis of their own equipment and methods, coupled with a wide knowledge of the methods of manufacture of a wide range of other products," he answered. "As for the inventors, they must bring their work to the attention of such manufacturers. After all, the big problem is not how to invent, but how to find the manufacturer who needs the invention. There are many such manufacturers but to seek them out requires at least as much hard work as it takes to create the invention."



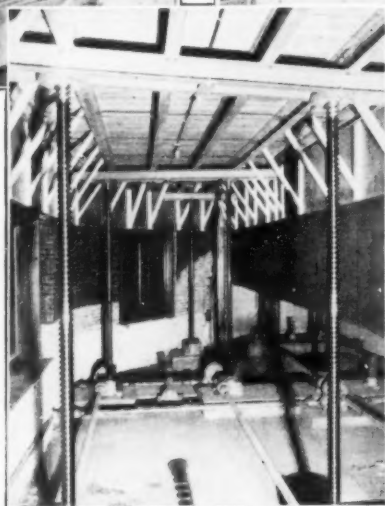
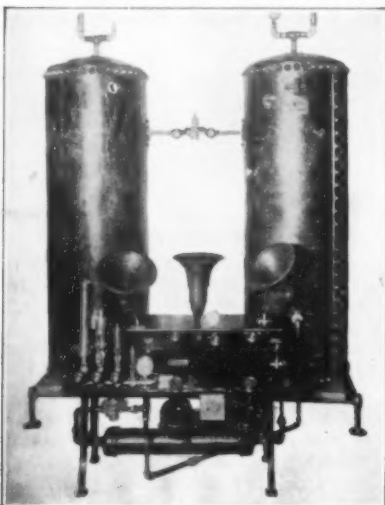
ORGAN CONSOLE

S. L. Rothafel is here shown standing beside one of the huge organ consoles of the Roxy theater, New York City. From this and other consoles, skilled organists control the flow of air through the organ pipes located in another part of the theater. Notice the complexity of the various organ controls



THE HOSPITAL

The really modern theater provides for every possible emergency. Here is part of the completely equipped hospital in the Roxy theater, where even a major operation can be performed if necessary. In addition, all of the ushers carry small first-aid kits for the treatment of fainting and the like



PIT ELEVATOR

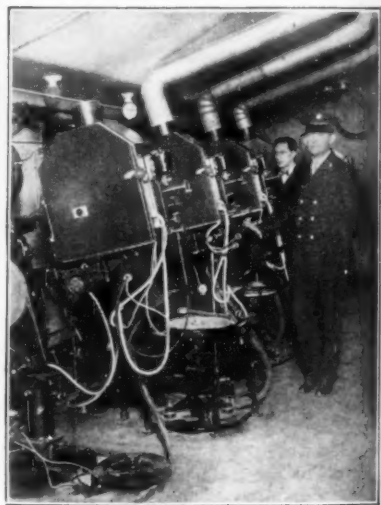
The entire orchestra pit, with all of the musicians, can be raised or lowered at will

NOISE MAKERS

Various sounds for accompanying the pictures are produced with these instruments

PROJECTION BOOTH

Standard projectors and those for "talking movies" are part of the regular equipment

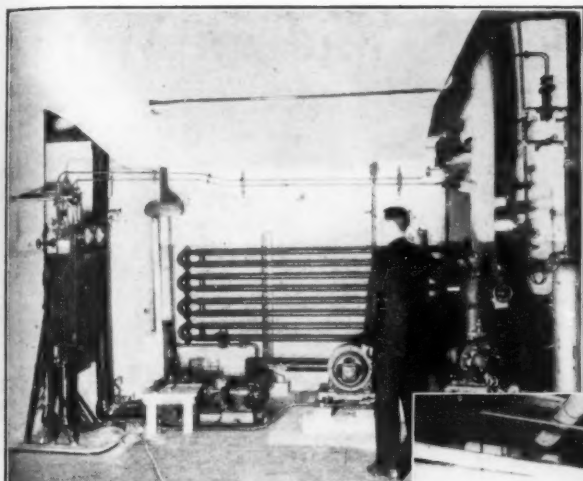


The "Movie" Theater Up-To-Date

NOT so many years ago, the average motion picture theater contained only a series of seats, a screen, (more or less smooth), and a projection booth. The manager gave little thought to the comfort of the patrons—in the summer they might swelter, and in the winter be subjected to the vagaries of an inefficient heating plant. They came to see the "movies" regardless, because they were new. Patrons were not discriminating, and furthermore there was not much keen competition. But as the art of motion-picture production grew by leaps and bounds, and the pictures to be presented became more pretentious, the number of exhibition houses increased. Then, the effects of competition came to be noticeable, and the managers cast about for methods of attracting patronage to their particular houses. First, only special attractions were advertised as "drawing cards," but that was not always enough. Then managers began to improve their theaters and patrons became attracted to the various personal comforts that were offered. The old style of

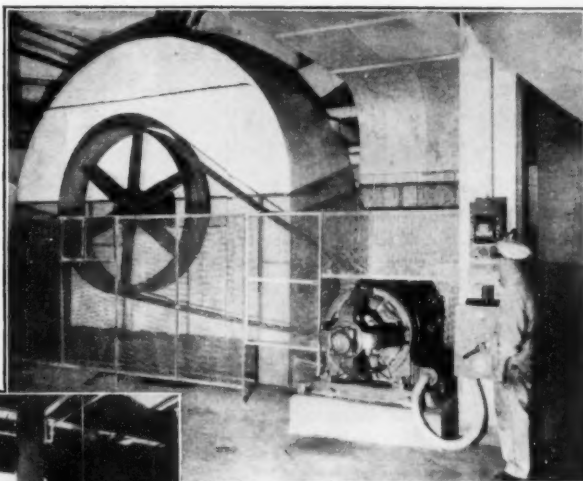
uncomfortable hard seats were replaced with other more spacious and upholstered chairs that made sitting through a long program a pleasure rather than a veritable torture. Soon the sign "20 degrees cooler than the street" became a common-place method of attracting the summer patron to the cool, comfortable, darkened depths of the theater. But the end was not yet. The theaters became more and more ornate, and still further attractions were added. It might be said that the ultimate in theatrical design for the presentation of motion pictures has now been reached. In New York City there are several large houses dedicated to the presentation of motion pictures that are, in every sense of the word, palaces. The Roxy theater, the result of years of planning on the part of S. L. Rothafel, well known radio entertainer, is an excellent example of these. We reproduce on these pages several photographs, specially posed for the SCIENTIFIC AMERICAN, of the more striking features of this well-designed theater. It seems that nothing has been slighted

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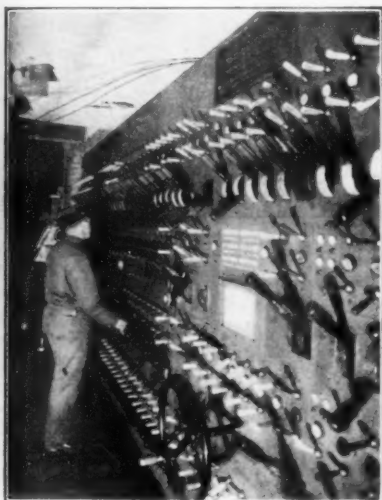
WATER COOLER

The water that is piped to the various drinking fountains located in various parts of the theater is first cooled to the correct temperature by means of the complete refrigerating plant illustrated above. This is a great improvement over individual drinking-water fountains cooled by ice



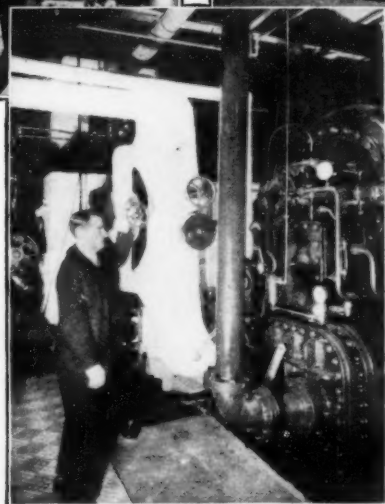
VENTILATION

In order that the patrons may be in absolute comfort at all times, it is essential to have complete ventilation. In the Roxy, huge fans of the type illustrated above take care of this, effecting a complete change of air in the theater at predetermined intervals, thus completely getting rid of the stale, impure air



AIR COOLER

In summer, the air in the theater is cooled by this large efficient refrigerating plant



SWITCHBOARD

A section of the very complicated lighting switchboard is shown directly at the left

SEAT INDICATOR

In the balcony, this board of indicating lights shows exactly which seats are vacant

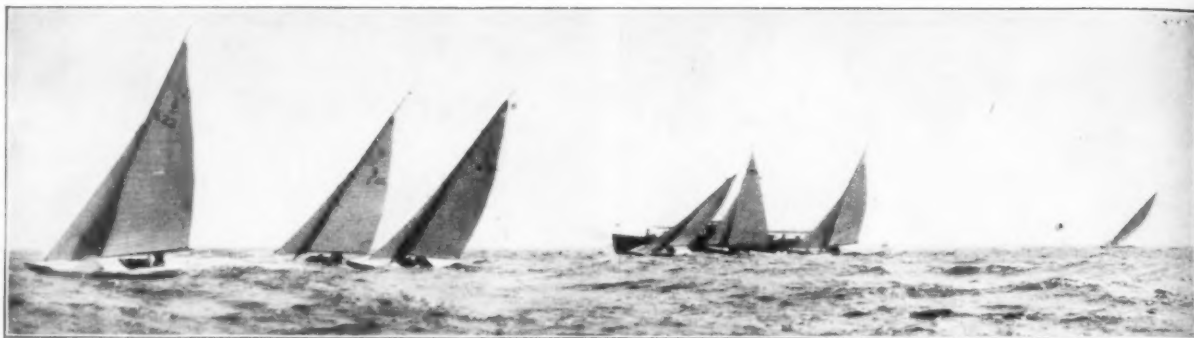


Many Modern Comforts Provided

and that every comfort of the patron has been thought of. No longer is the theater a mere place in which to view a motion picture. Instead it is more of a place of entertainment and a club combined. There are rest rooms, furnished in the best of taste and equipped with every comfort that patrons could possibly wish for. The lobbies are spacious and are so furnished and decorated that persons visiting the theater for the first time are entranced as they enter, and often spend some time in viewing them. Within the theater itself, the ushers conduct one to his seat with the utmost courtesy, and upon being seated, one finds that he is as comfortable as he would be in his own home. In the hot days of summer, there is always coolness to be found in the modern theater. This is provided by means of up-to-date refrigerating plants and ventilating systems. At convenient places there are inviting drinking fountains where water of just the right temperature may be obtained. Here again, refrigerating plants are employed and the cooled water

is circulated to the various outlets. Should it so happen that a person be taken sick while in the Roxy theater, an attendant is always at hand to render first aid, and if necessary, rush the ailing one to the completely equipped hospital that is an integral part of the equipment of the theater. In the projection apparatus, many changes over older types of projection machines are noticeable. The booth is cool and well ventilated, and the machines are of the latest types. Most prominent among them are those which are arranged for the projection of the newest "talking movies." Complete installations for the presentation of two different types of the latter are available. Both of these systems have been described in this magazine. One is the Movietone, in which the sound record is made directly on the motion-picture film, in a narrow space at the side of the pictures. This was described in detail in the September, 1927, issue. The other method, described in the June, 1927, issue, is the Vitaphone, using a disk record for sound recording.

Scandinavian Six-meter Yachts Win



Photographs by Margie Rosenthal

START OF THE THIRD GOLD CUP RACE, SAILED IN A FRESH BREEZE AND ROUGH SEA



NOREG, WINNER OF SEAWANHAKA CUP



CLYTIE, DEFENDER OF SEAWANHAKA CUP



MAY-BE, WINNER OF GOLD CUP

THE Scandinavians have sailed back to Europe taking with them two international yachting challenge cups, Norway having captured the Seawanhaka cup, and Sweden, the Scandinavian gold cup.

The races, nine in all, were sailed on Long Island Sound and in winds which varied from very light airs to fresh breezes of 20 knots or more. It was a case of fair winds and no favor, and it is frankly admitted that the clean sweep made by the Norwegians, under a wide variety of weather conditions, proves that the foreign designers and yacht builders, at least in the design and construction of the smaller racing craft, have taken a very decided lead over this country. They seem to have achieved in the smaller classes the same supremacy which we have shown so long in the larger yachts built for competition in the famous "America's" cup contests.

The Seawanhaka cup, put up some 30 years or more ago for international contests, was carried overseas long ago and, after traveling to and fro as

it was captured by various foreign clubs, was brought back to this country

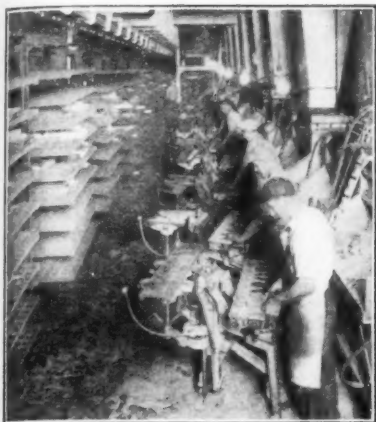


LEA, DEFENDER OF GOLD CUP

two years ago by the American six-meter yacht *Lanai*. In this year's racing, the Norwegian *Noreg*, owned by Crown Prince Olaf and associated yachtsmen, lifted the Seawanhaka cup by winning two out of three races.

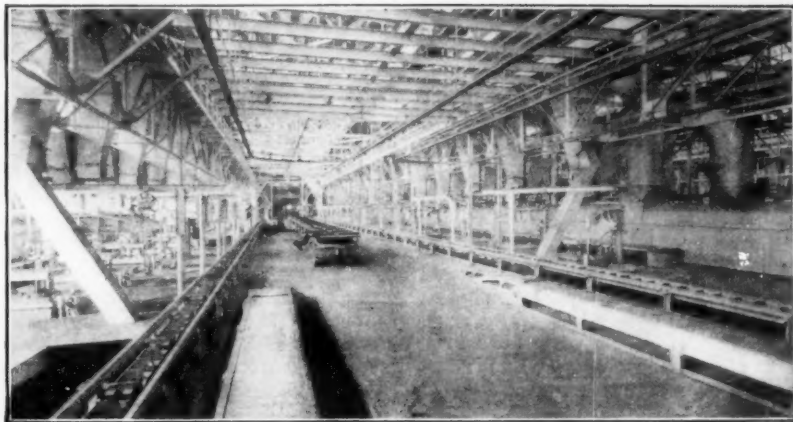
The Scandinavian gold cup put up by the yachtsmen of northern Europe for international competition, and won recently by America, was challenged for by seven nations: Norway, Sweden, Finland, Denmark, Holland, Italy and England, each of which sent its best boat to Long Island Sound. The Scandinavians eliminated all competitors, and before the last race each of them had won two races, the Swedish boat *May-Be* winning the third race and the cup.

The races were won, not mainly by seamanship, as many suggested, but because the form of the boats and the cut of their sails were superior. This was proved when, in a race for all nine boats, in which the craft changed skippers, our Sherman Hoyt brought the Scandinavian yacht, *May-Be*, home again an easy winner.



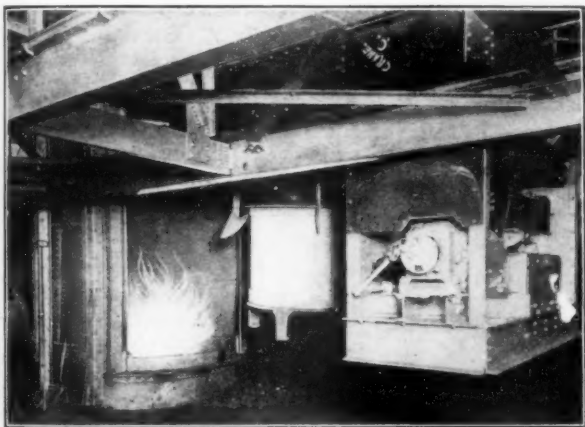
THE CORE MAKERS' TABLES

Automatic conveyors deliver sand; the racks carry the cores to the baking ovens



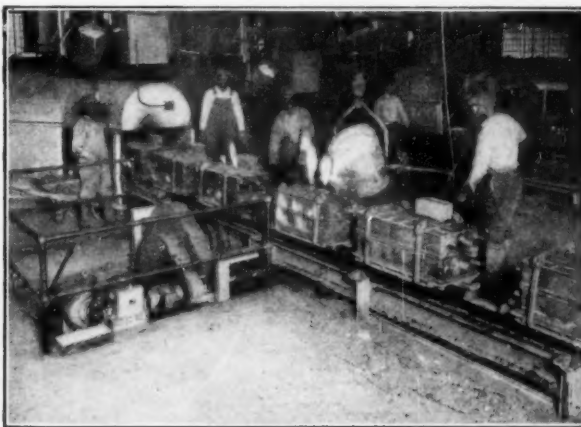
HERE THE FLASKS ARE PREPARED FOR POURING

Riding on long conveyors past the molding benches, the assembled cores are fitted over with molds as they move, preparatory to the pouring operation which is illustrated below



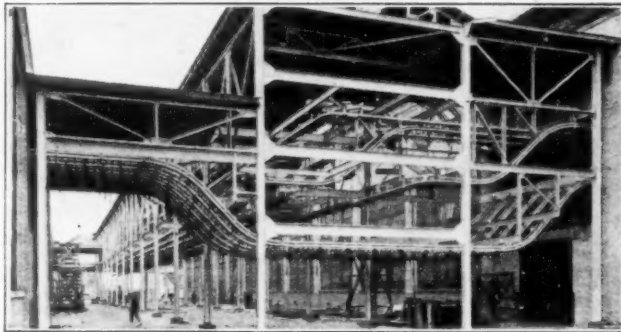
CHARGING A CUPOLA ▲

Continuous charging of each of the six cupolas is carried on entirely by machinery in the new Buick foundry as shown above. The materials are weighed and placed in the big bucket, which is hauled up through a hatchway cut in the floor, then pushed inside the cupola. At this point in its journey, it is tipped over, dumping its contents into the seething mass in the cauldron below



▲ POURING AND COOLING

(Above) Overhead trucks coming from the cupolas tilt the molten iron into hand ladles, also hanging from monorails. The workmen stand on a moving platform which keeps pace with the moving flasks. (Left) From the shake-out grates, after removal from the molds, the castings travel on overhead conveyors for an hour and a half to cool them sufficiently for further foundry handling



The New Modern Foundry Arrives

HAVE you ever stood in the gloom of a foundry? Remember the brawny, panting, sweating gnomes, bare from the waists up, dodging about the floor with ladles of liquid flame? Have you heard the scream of pain as molten iron spilled upon a workman's hand? Have you seen a man drop senseless from the heat and the poison-laden gasses? That picture is fading and in its place is dawning the foundry light and airy as a well-planned machine shop, ventilated by forced draught which keeps the air circulation constant, with ingenious machinery replacing the slaving humans for all of the heavier chores. The new day in foundry practice is opened with the swinging into production of the largest and most modern grey-

iron foundry in the world by the Buick Motor Company at Flint, Michigan. Core making, assembly and baking, charging and discharging six 96-inch cupolas, pouring the molten metal, cooling, cleaning and finishing the castings—all rely upon machinery to an extent which makes the old-time foundryman rub his eyes with incredulity. The foundry building proper is 675 feet long and 123 feet wide, with cupolas, core room, pouring room and part of the cooling equipment, together with an elaborate conveyor system. The cleaning plant, 680 feet long and 240 feet wide, contains sand blasts, tumbling mills and other equipment to prepare the castings for the machining which puts on the final finish.

The Month In Medical Science

A Review and Commentary on Progress in the Medical and Surgical Field

By MORRIS FISHBEIN, M. D.

Editor of the Journal of the American Medical Association and of Hygeia

Safety Pins in the Stomach

CASES are reported again and again of people who swallow all sorts of metallic objects without any reason, except perhaps a disordered mentality. A physician in Newark, New Jersey, recently operated on a Polish woman, aged 35, who came to the hospital because of some difficulty in the lower part of her intestines.

When the physicians made an X-ray examination they discovered a large mass of material in the stomach and the operation included the removal of this mass. It consisted of an interlocking bunch of safety pins, the total weighing 295 grams or ten ounces. The patient told the physician that she had first swallowed the pins 13 years previously because she was hungry, that she kept up the practice for four or five months, and that she had given birth to four children in the meantime without any special symptoms related to the safety pins.

The Chance of Death from Cancer

IN the International Conference of Cancer Control held at Lake Mohonk, Dr. I. L. Dublin considered the chance of death from cancer for persons living today. His investigations were based on the records of the Metropolitan Life Insurance Company and showed that cancer as a cause of disability and death is increasing. Of course much of this increase is due to the fact that people nowadays are living longer than they used to, and they die from the diseases of advanced years rather than from the infectious diseases which formerly carried them off at an early age. In 1924 the probability at the age of ten of dying ultimately from cancer was exceeded only by the probability from three other causes: hemorrhage into the brain, chronic inflammation of the kidneys, and heart disease. Among women, cancer was third in the list, being exceeded only by heart disease and brain hemorrhage.

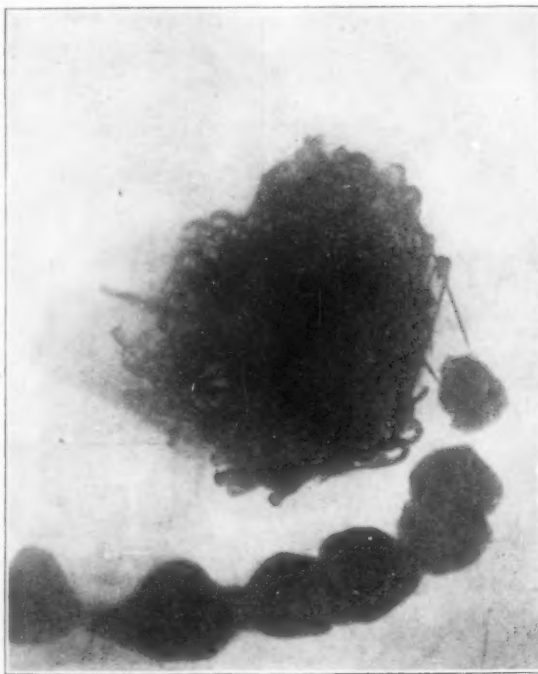
For each of the ages beyond 10 up to the age of 90, during the last 15

years, there has been an increase in the cancer hazard running approximately from 40 to 50 percent. The increase for women has been less than that for men, approximately 21 percent.

Dr. Dublin believes that the situation calls for intensive research of a type that is not yet being given to the investigation of cancer. Where we

slough away and ulcers are formed in their place.

The cause of cancer is still unknown. Various theories have received special attention, particularly those having to do with the effects of chronic irritation. It seems to be well established that chronic irritation will not in itself produce cancer, but that it will cause changes in the tissues that favor the development of cancer. Cancer of the mouth and throat is far more common in people who smoke than in those who do not. The two lines of attack that yield the most satisfactory results are surgery, and the use of radiant energy in the form of either radium or the X ray.



RESULTS OF METAL DIET

A Polish woman swallowed a quantity of safety pins because, she said, she was hungry. X-ray photograph shows how they lodged in stomach from which position they were removed

ought to be spending millions, we are spending thousands; where there are only hundreds of physicians especially trained to recognize and treat cancer early, thousands of physicians must be better informed on this subject.

The term cancer, as commonly used, is applied to all malignant tumors. Actually, malignant tumors are divided into at least two types. The first fact of importance about a tumor is its unlimited power of growth even at the expense of all the rest of the body. Frequently the tumor grows so rapidly that the blood vessels cannot keep up with it. Therefore, the cells distant from the blood do not receive sufficient nutrition to keep alive; they

properly cleaned between working hours; the walls, ceiling and windows were covered with lead dust; men were careless in handling the enamel mixture; the washroom was small, dark, and poorly ventilated, and there were only two shower baths in which the men could wash off the traces of lead dust before leaving for home. Even the lighting was bad.

More than half of all the cases of metal poisoning found in industry are due to lead, and nine tenths of all lead poisoning can be prevented by keeping the dust and fumes from entering the mouths and noses of the workers. For more than a quarter of a century physicians and public health workers

Lead Poisoning

AN investigation of 35 industrial and commercial establishments in Nashville, Tennessee, made by Drs. W. S. Leathers and Hugh J. Morgan, revealed hazardous processes involving the use of dangerous substances in four of them. In one enameling plant, 39 people were examined for lead poisoning. Only 13 of the 39 men examined failed to show evidence of the disease. Workers in practically every branch of the plant were affected and a survey of working conditions indicated difficulties not only with the actual working conditions themselves, but also with the hygienic accommodations in general use. Rooms were im-

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have been agitating for hygienic conditions in this country. Nevertheless, the situation outlined in the plant in Nashville is not unusual, as similar plants are to be found in many communities.

The number of deaths from chronic lead poisoning has diminished about one half in ten years, but there are still thousands of cases of lead poisoning of varying degrees among workers which do not produce death promptly.

A survey of the enameling plant mentioned revealed not only lead poisoning, but also general defects in the workers which should have been corrected. Every one of the workers had some defect, so that none of them could be given an absolutely clean bill of health.

A survey of industries recently made by Dr. J. P. Leake of the United States Public Health Service revealed the fact that lead is not infrequent in the dust in the air of all sorts of industries. The signs of lead poisoning are available early in the blood of the person affected. Serious symptoms particularly relating to the stomach and intestines occur, as well as the later effects in the form of paralysis.

The Tallest American Boys

DR. HORACE GRAY of the Illinois Institute for Juvenile Research, and Dr. S. T. Nicholson of the Hill School in Pottstown, Pennsylvania, have recently concluded a study to determine what type of American boy is the tallest. The investigation included examination of boys in private schools and in public schools, and also a study made in California of especially gifted children. Boys in eastern boarding schools were found to be as tall or taller than gifted boys of all ages in California. Boys from eastern boarding schools also were found to be taller in general by from 2.1 to 6 percent than public-school boys at varying ages. Private-school boys are in general taller than those in country day schools.

The ancestry of these boys is pretty generally American-British. Attempts are now being made in various schools in the United States to determine the relationship of height and weight to ancestry and to environment.

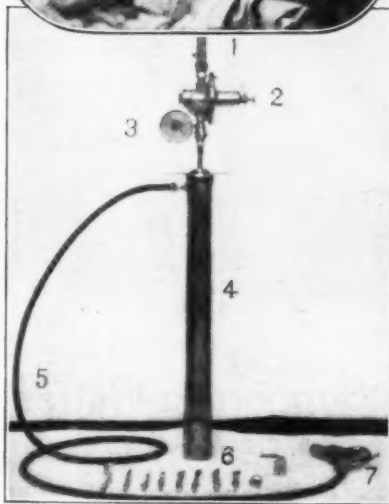
Rheumatism Cures

THE *Journal of the American Medical Association* has recently called attention again to a rheumatism cure exploited from Boston, and consisting mostly of aspirin and salicylic acid mixed with a little laxative and some vegetable matter. It is safe to say that 90 percent of patent medicines claimed to cure rheumatism are mixtures, with aspirin or similar drugs as their potent ingredient. Therefore, the patient purchases at a high price a commonly used drug and expects,

largely because of the advertising associated with his purchase, to secure remarkable effects.

A New Pneumatic Hammer

DR. HORACE C. PITKIN of Boston has recently described a new pneumatic hammer for use in surgery of the bones. One of these has been installed in the orthopedic operating room of the Massachusetts General Hospital. The hammer is operated by compressed air. Its speed is controlled by a throttle situated on



PNEUMATIC HAMMER

Top: Hammer in use. Note convenience of throttle to thumb. Below: Operating-room assembly; 1—delivery hose; 2—reducing valve; 3—pressure gage; 4—air cleaner; 5—sterilizable tubing; 6—osteotomes; 7—the pneumatic hammer itself.

the pistol-grip handle and it may deliver 3800 blows per minute. Not any of the moving parts are exposed and yet it is possible to sterilize the hammer completely by boiling it without taking it apart.

Gasoline and Oil Poisoning

THE increasing use of gasoline and coal oil is bringing to light numerous cases of poisoning from these substances, particularly in children who drink almost anything that may be standing about in open vessels. The inhalation of the vapor of gasoline will cause headache, dizziness, shortness of

breath, and if persisted in, unconsciousness and death. Drowsiness is an early symptom. In case of swallowing as much as an ounce of gasoline or benzene, unconsciousness comes on in from 10 to 15 minutes and death may follow shortly after. Most of the fatal cases occur in children. A woman aged 20 years died after drinking one ounce of gasoline, but another woman recovered after drinking a pint.

When coal oil is swallowed the effects are like those of alcohol, but much more poisonous, particularly in children. There is a burning pain in the throat and stomach, vomiting, a good deal of thirst, drowsiness, shortness of breath and perhaps unconsciousness.

When a child drinks either of these dangerous substances, vomiting should be induced as soon as possible. This may be brought about by inserting a finger into the throat or by causing the child to drink large quantities of hot salt water. The symptoms particularly of sickness and shock are best treated by a physician, who will provide medicinal stimulation when necessary.

Ultra-violet Rays in the City

AN investigation conducted jointly in the Department of Health of the City of Chicago and the Department of Physics of the University of Chicago by Drs. Herman N. Bundesen, commissioner of health, Harvey B. Lemon, I. S. Falk and Mr. E. N. Coade, reveals the fact that not enough ultra-violet light comes through from the sun in Chicago during the winter months to be of any significance. Under the supervision of Prof. Henry G. Gale of the University and Prof. A. J. Dempster, records of Chicago's sunlight were made daily from November, 1926, to May, 1927. Every day a photograph of the sun's spectrum was taken on a portrait film. The value of the sunlight as recorded in Angstrom units measured from 2900 to 3200. Investigations made by Dr. Alfred Hess in New York City show that light of this potency has little effect in preventing rickets. In March, when Chicago's atmosphere is heavily laden with smoke, the amount of ultra-violet rays coming through is not sufficient to have potency. The actual fact of the matter is that the ordinary incandescent bulb has about as much power as the sunlight of Chicago in winter.

In addition to studying the effects of sunlight, the investigators studied the power of special forms of window glass to transmit ultra-violet rays. Their reports agree with those of the Council on Physical Therapy of the American Medical Association to the effect that the special glasses manufactured for this purpose will transmit such ultra-violet rays as come to them from the sun.

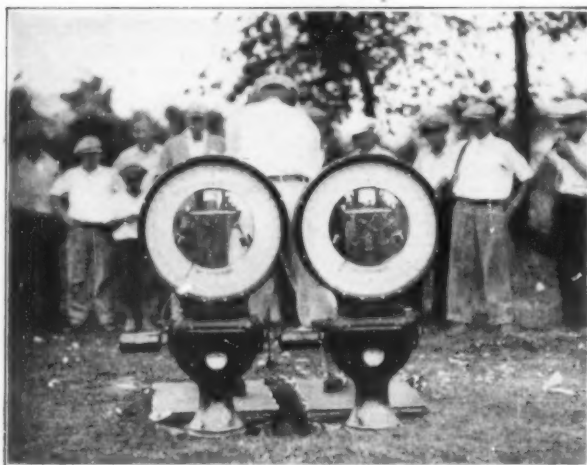


FIGURE 1

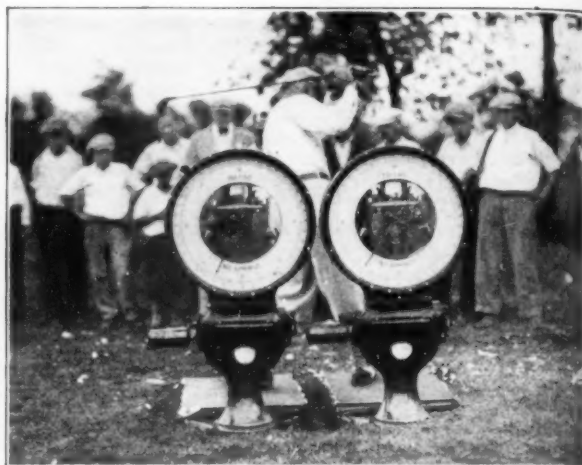


FIGURE 2

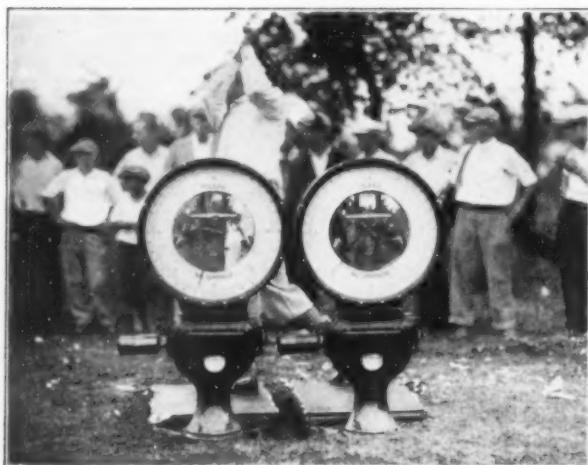


FIGURE 3

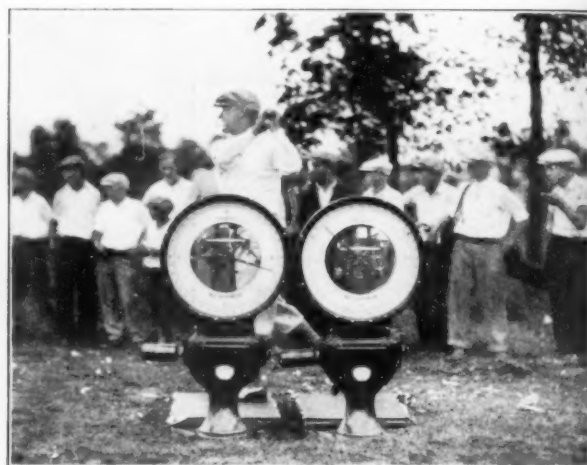


FIGURE 4

Which Foot Supports a Golfer's Weight?

By C. BOND LLOYD

GOLF writers, players and instructors have argued and theorized for years as to how the weight is shifted and distributed during the golf swing. There has been much controversy, particularly as to how the weight was distributed at the top of the swing.

Harry Pressler, one of California's leading teachers, says in part: "As the club goes back, the weight shifts to the right until at the top of the swing, 80 percent is on the right foot. The left heel is off the ground and the left shoulder is around until it is almost on a line with the ball. As the club comes down the weight shifts to the right, 90 percent of the weight being on the right at the finish of the swing." I have no idea as to where Harry gets his information about the weight shift. The photograph, Figure 8, of Mr. Richard T. Jones, Jr., of New York, a very fine player, shows that, at the finish, his weight is practically evenly

distributed, there being only five pounds difference in favor of the right.

Johnny Farrell, well-known eastern professional, says: "As the club goes back, the left leg has continued its inward movement and the right leg stiffens, giving the appearance of bearing most of the weight. This, however, is an illusion. At the top of the swing the weight is evenly distributed and the body still maintains its balance without sway." Pressler and Farrell express widely different opinions as to the weight distribution. Harry Vardon is emphatic in saying, "At the top of the swing the weight is on the right foot." J. H. Taylor further emphasizes this when he says, "As the club swings back, the weight should be shifted by degrees until, at the top of swing, the whole weight is supported by the right leg."

P. A. Vaile, who has written many books on tennis and golf, says, "Let

us consider the distribution of weight in the drive, which is of fundamental importance. Where is the main portion of the weight at top of swing? The winners of 16 British Championships say that the weight is mainly on the right foot. They are absolutely wrong. The weight is mainly on the left foot and never by any possibility on the right."

During a national amateur tournament, held at Minikahda, I had an opportunity to place two gravity scales for test purposes. A series of fast grafex pictures and also motion pictures showed that the weight shift varied, depending on who played the shot. Mr. Harold Weber, a very sound golfer, showed at top of swing 81 pounds on the left and 63 on the right. Ellsworth Augustus, who is a very long driver, showed 63 on the left and 122 on the right.

Still more interesting were the tests

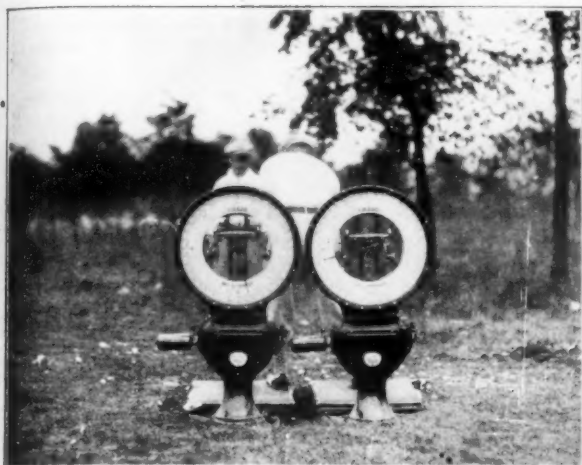


FIGURE 5

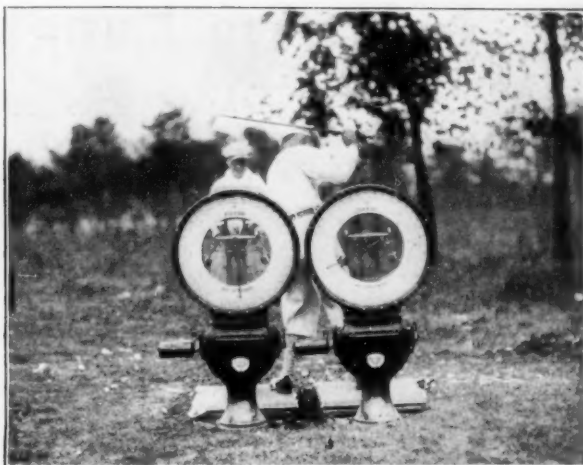


FIGURE 6



FIGURE 7

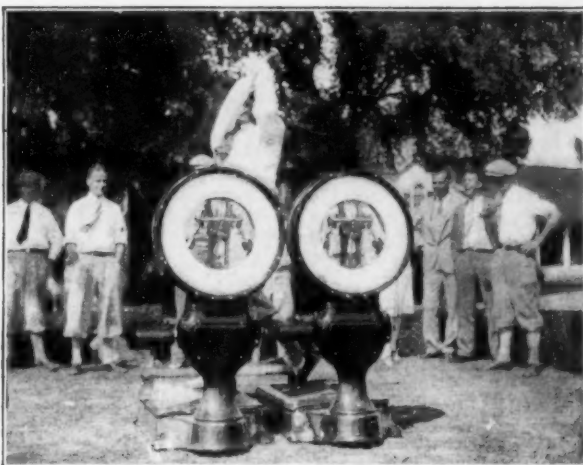


FIGURE 8

made during the swing of Jimmy Kenny, well-known professional at the Sylvania Golf Club.

Figures 1 to 4 show Jimmy driving. He hit what is known as a "screamer" during this shot. It was necessary to use four cameras during the swing. Figure 1 shows the stance with weight distributed as follows, 83 on the left and 81 on the right. Figure 2, at top of swing shows 84 on the left and 80 on the right. Figures 3 and 4 show the shift from right to left, not left to right, while at the complete finish, the weight is mostly on the left.

In Figures 5, 6 and 7, Kenny is seen making a shot with a midiron. Note that slightly more weight is on the left foot than when using the driver. At top of swing he shows 102 on the left and 62 on the right foot. At the finish, all but 14 pounds is on the left foot.

Either the British "experts" are wrong or Kenny will have to start changing his swing. When Jimmy was interviewed with reference to weight shift he said, "Why shift the weight during the swing? If it is transferred to the right, it will cause the player

Who Is Right?

IT is no exaggeration to say that—at least according to the best versed statisticians in that field—there are not less than two million golf players in the United States today. Evidencing this fact is the keen interest which many of our readers have shown in the articles which we have from time to time published, discussing different phases of the famous Scottish pastime.

The accompanying article by C. Bond Lloyd will doubtless cause considerable discussion. In fact, it has already, in manuscript form, created the expression of diverse opinions on the part of many golfers of experience. We shall publish in a forthcoming number an article by one of the most prominent of our professional players, giving his views on the subject, and discussing his premises fully from the standpoint both of the prominent player and teacher.

The Editor.

to sway, which means that the head of the club in the down swing does not hit the ball squarely and has a tendency to hit behind the ball or else catches it on the up swing. If I wanted to get 80 percent of my weight on the right foot at the top of swing, I would have to sway at least five inches. If this is sound golf, I will have to revise my method of teaching."

After some 20 years of taking motion pictures of expert players as well as of novices, I have noted that the "dubs," as they are inelegantly called, have one very pronounced fault. This is body sway. Falling back after hitting is another very common fault. In talking to one of the poorer players recently, after I had shown his motion picture, he remarked, "How can I get my weight on the right foot at top of swing as the experts tell me without swaying?" My only answer to this was that I was convinced that the "experts" really did not know what the weight shift was. Alexia Sterling Fraser well says, "Keep the weight well on the left foot. It will steady the body and prevent swaying."

Learning Language By Its Feel

The "Teletactor" Enables the Deaf to Hear Through Their Finger Tips

By ROBERT H. GAULT, Ph.D.
Northwestern University

HOW far can one sense organ go in substituting for another that is out of commission?

The blind man learns casually and by training, too, that touch can carry him a long way. What can this sense do for the deaf man? Can he by any sort of instrumental aid become aware of speech, and learn its meaning by the way it feels upon his skin? Can he obtain any help in this direction by way of the "feel" of speech? Can the same feel be of any service to the mute or the semi-mute in his effort to improve the quality of his spoken language? Recall that the mute is in his speechless state because he cannot hear his own voice, to say nothing of the voices of his neighbors. He lacks the guide that hearing affords.

THE above questions are aimed at the possibility of substituting organs of touch for ears. Theoretically that does not sound so bad because if we go back far enough toward the beginning of animal history we find a point at which a sensitive skin did serve as ears. Primitive forms of animal life *feel* their environment through the sense of touch or of vibration.

This alone suggests the possibility of developing a method whereby speech may be received through the sense of touch exclusively.

And it raises the query—how sensitive is the skin? How nicely can it discriminate amongst all those signs that, to the ear, compose meaningful language?

To begin with, the sense of touch in the skin is able to detect vibrations of a suitable intensity in a solid ob-

ject when they occur even as frequently as 2600 to 3000 times a second, and it is extremely probable that it can do even much more than that.



SINGLE UNIT TELETACTOR

The single unit first used was closely similar to a radio head set

Until very recently the highest figure known in this connection was 1600. I have been able to determine the higher figure by means of a five-unit "teletactor."

This "teletactor" was designed and built for me through the courtesy of the Bell Telephone Laboratories, and embodies their expert knowledge of electrical systems for communication. Telephone currents from a high-quality transmitter pass through a vacuum-tube amplifier and into an electrical filter where the frequencies of the complex speech-current are separated into five groups by the special filter. Each group of frequencies then goes to a separate receiver unit so that each unit is actuated by only a definite

range of speech sounds. The five receiver units have a common mounting so that the "teletactile listener" may hold it in his hand with his thumb or a finger resting on each of the five receivers. The receiver unit for the thumb responds to speech vibrations less than 250 per second; for the little finger to those of more than 2000 per second; the other fingers are affected by vibrations in the ranges of 250-500, 500-1000, and 1000-2000 respectively.

Now, to discover whether a finger can detect vibrations that are occurring 2000 or more times a second, disconnect the filter from all units excepting the one in contact with the little finger. (See the diagram on the opposite page.)

THEN let some one pronounce several vowel qualities into the microphone or employ an oscillator by which one can produce vibrations of a known frequency. Does anything happen against the little finger? Persons with a moderate degree of tactual training will answer in the affirmative. They can feel vibrations that are occurring at the rate of 2600 (and more) times a second. This is a very important finding. All the energy of speech is carried by frequencies of vibration far below 2000 a second.

The skin equals the ear in detecting differences in intensity of vibration (differences in *loudness*, as a hearing person would say).

Fingers are by no means as expert as ears at distinguishing between frequencies—distinguishing *pitch*, as the ear says it. But fingers have many more resources than I have indicated so far. After suitable practice



RECEIVING SPEECH THROUGH THEIR THUMBS

An opaque screen hides the speaker from his pupils, who are attempting to write what is being said



THEY GREATLY ENJOY THIS EXERCISE

One subject is speaking into the thumb of another, an especially strong way to get at the speech of semi-mutes

they can identify vowel and diphthongal qualities and some consonantal qualities combined with vowels. They can pick up words. They can feel accent, emphasis, rhythm and tempo in speech. They can catch the smaller and greater pauses that occur in connected speech as it comes through the teletactor system. In other words, they can lay hold upon the pattern of sentences and of continued discourse. This is an indispensable tool that all hearing people put to great use. We hear fewer words as words than we imagine. We go a long way toward understanding our neighbor's conversation by the swing of his speech.

During more than four years the writer has been making experiments looking toward a wide application of the tactual sense to develop the use of language amongst young deaf folk. During the last three years the enterprise has been under the auspices of the National Research Council, now under the Carnegie Institution of Washington. In May, 1926, two young deaf people managed to pick up a story of about 250 words—a story they had never known before.

IT was composed for the occasion. They "heard" it through the thumb of the left hand and wrote it down with the other hand. These two in two years had had an aggregate of 280 and 290 hours of laboratory practice on a great variety of exercises.

But suppose the "teletactile listener" can at the same time see a speaker's face and feel his words. Then, assuming about 60 hours of tactual training, the "listener" can interpret speech anywhere from 30 percent to more than 100 percent more accurately than he can do without the aid of touch but by seeing the speaker's face, and by that means alone. Much of speech that can be felt cannot be seen. This opens up a way whereby the training and education of the deaf in their schools can be greatly speeded up. The prospect is all the more bright because a group of persons can simultaneously feel a given speaker's voice, assuming that several receivers are connected in series with the microphone. Accent, emphasis, rhythm, tempo—the pattern of sentences can be felt through the

PRACTICE

A pair of subjects receiving the speech of the author in their thumbs and simultaneously reading his lips and face while they attempt to write—a method that greatly facilitates the development of a language sense and improves lip-reading. The 300 hours of drill required to enable one to pick up a story is really a short time when expressed in terms of school days



teletactor, and by these characters alone one can go a long way toward understanding speech. In fact, when we hearing people listen to conversation we do not begin to single out all the words that are uttered. We catch large patterns and jump at their meanings.

It is of no mean consequence that



FIVE ELEMENT TELETACTOR

Each finger and the thumb receives its assigned range of pitch frequency

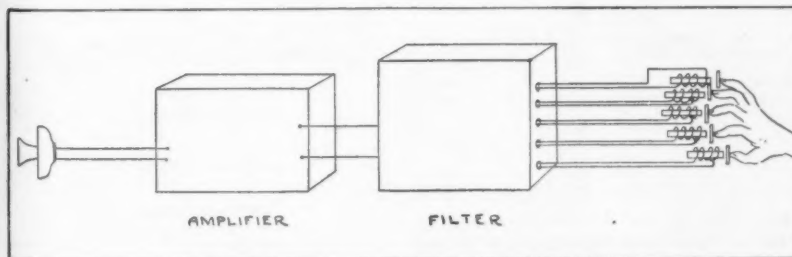
deaf subjects enjoy the feel of speech. They get a thrill from the swing of it. But it is not alone from the "swing." They like the feel of some vowel and diphthongal qualities more than others. This raises the question whether one can learn to enjoy music from feeling it. Preliminary experiments in this direction have brought very encouraging results.

Can the method afford an independent means of understanding speech? The only way to answer

satisfactorily the question is to equip a group of deaf youngsters with teletactors at the very moment of their first entering school and to keep them in touch with this equipment throughout the school day and successive school terms. If they can live with tactual signs of meanings, as the rest of us have lived with auditory signs, I am convinced they can learn to understand speech by its feel.

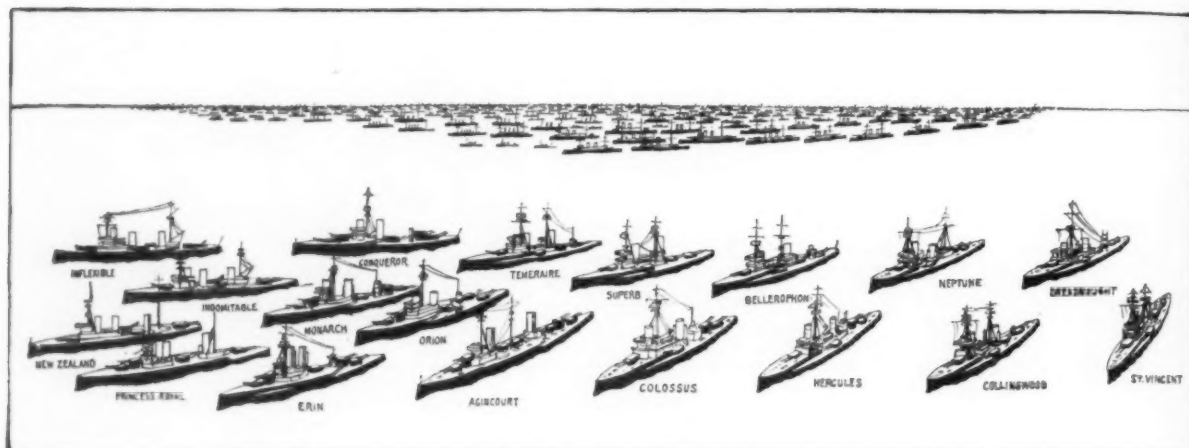
The sense of touch opens a gate to the improvement of speech. Here is a superior method for making the mute acquainted with syllabication, accent, emphasis, rhythm, and the tempo of speech, in short, with the pattern of language as the experimenter speaks it. Once the feel of all these characters of speech gets "into the bones" it bears good fruit in the manipulation of one's own speech—even in pronunciation of isolated words. Furthermore, when the semi-mute feels his own voice in the receiver upon his own fingers he makes a very interesting discovery: that he can do with his vocal apparatus more than he ever could before. Here is a motive that encourages him to play with his own voice. Put a group of semi-mutes simultaneously into connection with the teletactor system, let each of them in turn use his voice at the transmitter; there is a profitable game of exploration and discovery that they will play at indefinitely.

WHAT is the future of this work? Schools for the deaf will, I think, undoubtedly some day be equipped for making full use of the sense of touch as a medium through which to teach language, and in all school exercises in which language is a tool: the teaching of geography, for example. This means that they will have a microphone at the teacher's desk or suspended from her neck. Beneath the desk will be the necessary batteries and amplifier. At every desk occupied by a deaf pupil will be a receiver which the pupil may hold in his hand to feel the teacher's words, while at the same time, if necessary, he observes her face. Some day there may be a portable "teletactor" for out-of-school use.



SCHEMATIC DIAGRAM OF THE TELETACTOR SYSTEM

At left is the transmitter. Wires connect it with the receiving unit whose filter sends to each finger its assigned frequency range. The finger impressions are combined in the brain



HOW GREAT BRITAIN FULFILLED THE WASHINGTON TREATY

The 18 British dreadnoughts in the foreground were scrapped within one year of the Washington Treaty. The fleet on the horizon includes 639 ships, most of which had been destroyed, voluntarily,

before the Treaty. In that fleet are 24 battleships, 33 armored and unarmored cruisers, 55 high-speed scout cruisers, 10 flotilla leaders, 277 destroyers, 116 submarines, 95 torpedo boats, et cetera

The Post-War Navies

How the Overgrown War Fleets of the United States and Great Britain Were Brought Down to a Peacetime Basis

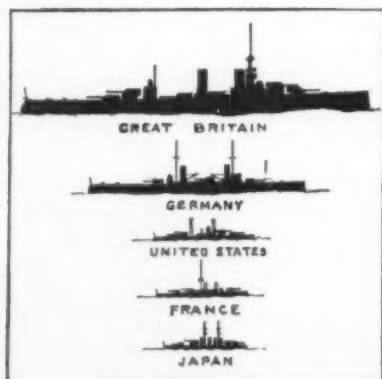
By J. BERNARD WALKER

SINCE the close of the World War, and particularly following the Washington Treaty, so much insidious and disturbing naval propaganda has been spread abroad, that there is a crying need for a plain statement of the facts regarding the naval situation, covering the period from the Armistice

Empire, widely scattered, was to develop its full strength on the Continental battlefields, if America was ever to land its armies in France, the powerful German fleet must be shut up within its home waters, and the high seas must be swept clear of enemy raiding forces. This was a gigantic task, and it was accomplished only by building up the already powerful British fleet until its preponderance of strength was overwhelming. Every shipyard, public and private, was working at full pressure during the four and one-half years of the war.

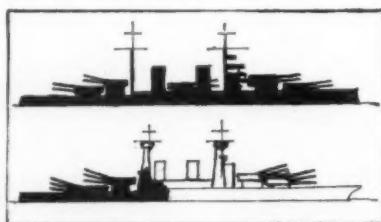
the Armistice the white ensign was flown by 1354 combatant vessels, with an aggregate of 3,250,000 tons, forty-two of these being capital ships of the dreadnought type." Also there were 24 pre-dreadnoughts, 109 cruisers, 13 aircraft carriers, 527 destroyers and torpedo boats, and 137 submarines. This gigantic force completely overshadowed the combined fleets of the United States, France, Italy and Japan.

When the surrendered German fleet committed *hari kari* at Scapa Flow, the last vestige of a potential enemy disappeared, and Great Britain vol-



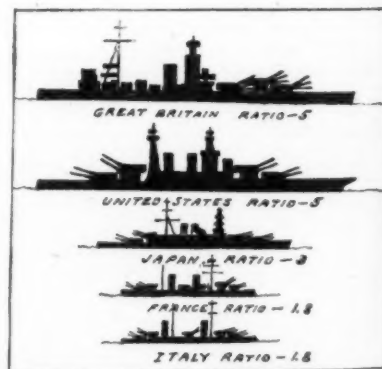
FLEET STRENGTH IN 1914

The United States fleet stood third, with a slight lead over that of France



DREADNOUGHTS DESTROYED

Completed tonnage destroyed by United States, 195,443 tons; by Great Britain, 473,570 tons



STRENGTH SET BY TREATY

The Treaty moved the United States fleet from a poor third to front rank

and the Treaty up to the present day. At the outbreak of the war it was realized that the keystone of the whole system of allied attack and defense, present and prospective, was the British navy. If the British

It is not generally known that from 1914 to the Armistice, a mighty fleet of new fighting ships was added to the British Navy. In his notable work, "Navies and Nations," just out, Bywater writes: "At the date of

untarily set about the work of reducing her fleet to a peacetime basis. The work of demolition went forward so rapidly that early in 1923, before the French had signed the Washington Treaty, she had struck off her navy lists, and scrapped, dismantled or sold for scrapping, the huge fleet shown in the leading illustration of this article. This included a total of 657 ships of a total displacement of over 1,500,000 tons. Into this enormous scrap heap went the 18 modern, war-tested dreadnoughts, destroyed in accordance with the Washington Treaty of 1922. All this was done before we had scrapped a single ship, the United States and Japan awaiting the signature of the French

This wholesale voluntary scrapping of all her pre-dreadnoughts, and 18 of the dreadnoughts that fought in the first line at Jutland, was done in advance of the required date, as a member of the government said in Parliament at the time—"that this country should give a lead in good faith, and to show that it is our intention to carry out, in the spirit and in the letter, this great Treaty for the limitation of armaments."

The famous Washington Treaty of 1922 aimed at the reduction of

U. S. Dreadnoughts Destroyed

	Tons Displ't	Percent C'mpl'd	Tons D'tr'd
South Dakota...	43,200	38.5	16,632
Indiana...	43,200	34.7	14,991
Montana...	43,200	27.6	11,923
North Carolina...	43,200	36.7	15,855
Iowa...	43,200	31.8	13,737
Massachusetts...	43,200	11.0	4,752
Lexington*	43,500	33.8	14,703
Constitution...	43,500	22.7	9,875
Saratoga*	43,500	35.4	15,399
Ranger...	43,500	4.0	1,740
Constellation...	43,500	13.4	5,829
United States...	43,500	12.1	5,264
Delaware...	20,000	100	20,000
North Dakota...	20,000	100	20,000
Washington...	32,600	75.9	24,743

Total Destroyed 195,443

*Completed as airplane carriers.

TABLE 1

nation, which they had a perfect right to do.

This fleet of 657 destroyed ships included 38 dreadnoughts and pre-dreadnoughts; four battle cruisers; 33 cruisers, armored and unarmored; 55 light, high-speed scout cruisers; 10 flotilla leaders of over 30 knots speed; 277 destroyers of 27 to 35 knots speed; 95 torpedo boats; 20 monitors built during the war; 116 submarines and four extemporized aircraft carriers.

Tons Destroyed

	Dread- nought	Pre-Dread- nought
U. S.	195,443	302,749
G. B.	473,570	344,800

TABLE 2

the swollen wartime fleets to a peacetime basis. It was called by the United States Government, speaking through its President. This was done because we recognized that the enemy's ships had been sunk, and that the only remaining fleets were those of the nations that had been in active and close alliance during the late war. It is true there was an outbreak of the sporadic antagonism between the United States and Japan, which was preventing these countries from following the lead of Great Britain in stopping all big ship construction and reducing the size of their wartime navies. Both the United States and Japan were building capital ships at a rate which boded ill for the future, and the nervous tension was being strained to the breaking point by a widespread and very active propaganda that threatened to have disastrous results.

The Washington Conference was a brilliant success, at least so far as capital-ship strength was concerned. The five leading nations, United

British Dreadnoughts Destroyed

	Tons Displ't
Dreadnought.....	17,900
Bellerophon.....	18,600
St. Vincent.....	19,250
Inflexible.....	18,750
Superb.....	18,600
Neptune.....	19,900
Hercules.....	20,000
Indomitable.....	18,750
Temeraire.....	18,600
New Zealand.....	18,800
Lion.....	26,350
Princess Royal.....	26,350
Conqueror.....	22,500
Monarch.....	22,500
Orion.....	22,500
Australia.....	19,200
Agincourt.....	25,000
Erin.....	23,000
Thunderer.....	22,500
K. George V.....	23,000
Ajax.....	23,000
Centurion.....	23,000
*Hoods—Four.....	5,520

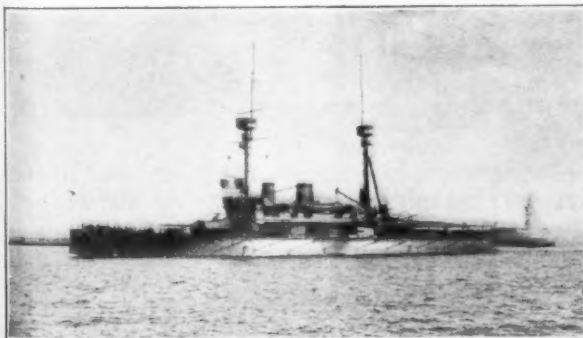
473,570

*Four super-Hoods begun.

TABLE 3

States, Great Britain, Japan, France and Italy, agreed to reduce their capital-ship strength to a ratio of 5-5-3-1.8-1.8 respectively. Great Britain agreed to give up her traditional naval supremacy and accept parity with the United States, acting under the conviction that war between the two countries was unthinkable. She agreed to reduce her fleet still further by scrapping 22 capital ships that had fought at Jutland, and the two pre-dreadnoughts, *Commonwealth* and *Agamemnon*, which were all that remained of the pre-dreadnought fleet that she had already scrapped. Also she abandoned the construction of four super-Hoods of 48,500 tons upon which she had done a total of 5520 tons of construction.

THE United States agreed to break up the completed dreadnoughts *Delaware*, *North Dakota*, also *Washington*, the last named being 75.9 percent completed at the time. Also



LATEST BRITISH PRE-DREADNOUGHT
"AGAMEMNON"

Displacement, 16,000 tons. Armament, four 12-inch, ten 9.2-inch. Great Britain destroyed 24 pre-dreadnoughts, totalling 344,800 tons, of which 22 were scrapped before the Treaty



LATEST UNITED STATES PRE-DREADNOUGHT
"CONNECTICUT"

Displacement, 16,000 tons. Armament, four 12-inch, eight 8-inch. The United States, since the Treaty, has scrapped 15 pre-dreadnoughts, as represented by the Connecticut

we agreed to break up 12 super-dreadnought battleships and battle cruisers of over 43,000 tons displacement, which were upon the building ways in various stages of construction,

few of the younger officers of strong racial and religious prejudices. These constitute a small but loudly vocal body of propagandists, who have bitterly assailed the treaty, claiming

Senate Naval Committee that at the Washington Congress we gained everything that we wanted.

We hold no brief for the British or any other foreign navy, but we do hold a brief for incontrovertible truth, for fair play, and for good sportsmanship. This present article is written solely for the purpose of putting the exact facts of the naval situation, from the date of the Armistice down to the present hour, before the American people and their senators and congressmen. We feel assured that this presentation will prove to all fair-minded people (and that means the one hundred and ten million people of the United States) that the propaganda against other navies, and notably against Japan and Great Britain, has been utterly untruthful and tending most dangerously to break down the fine spirit of understanding and co-operation, which had grown up among these nations as the result of their combined operations during the supreme trial of the Great War.



LATEST BRITISH TREATY DREADNOUGHT "NELSON"

Displacement 35,000 tons (maximum allowed by Treaty); armament nine 16-inch guns; twelve six-inch anti-torpedo guns. Note that the 16-inch battery, in three-gun turrets, is grouped forward of a curious structure which carries bridges and fire controls

the most advanced being the *South Dakota*, 38.5 percent completed, the least advanced being the *Ranger*, upon which a total of 4 percent had been done. The *Washington*, 75.9 percent complete, was also destroyed.

The total amount of constructed dreadnought tonnage thus destroyed by the United States covered 15 ships and totalled 195,443 tons, as shown in Table 1. With the exception of the four super-Hood ships, all of the 22 British dreadnoughts were completed ships that had fought in the war. The total additional amount she thus destroyed amounted to 473,570 tons, as shown in Tables 2 and 3.

The outbreak of the war found us in the third position in naval strength. At that time, the navy and its friends were urging that to the United States rightly belonged the position of second in strength. That was the mark set and accepted. As the result of the war and the treaty, we have moved up to the first position, ranking with Great Britain. This was accepted as a gratifying result by the American people, by the press of the country, and by the great majority of the personnel of the navy. We were raised from third to front rank.

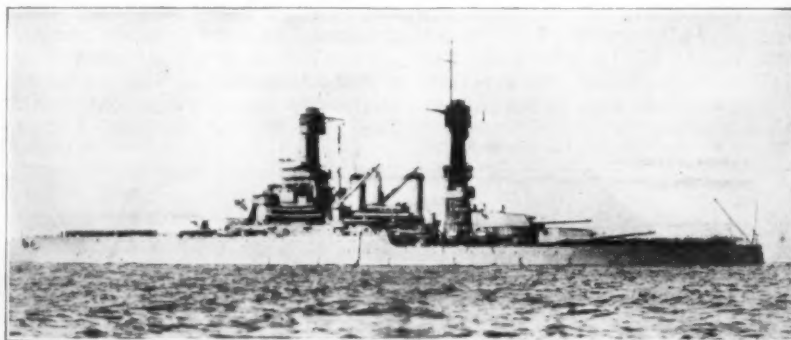
UNFORTUNATELY there existed and we fear still exists, though in less degree, a small but vociferous section of the navy that is bitterly opposed to the Treaty. It includes a few of our older officers, mainly retired, who do not appear to realize that the war of the Revolution is over. To them must be added a

that our navy's interests were sacrificed to Great Britain, who "put one over on us," and contrived to prevent us from becoming the leading navy in the world.

How in the world a nation that sacrificed one and one-third million tons of fighting ships voluntarily, and then followed that up by destroying nearly 500,000 tons of completed dreadnoughts, can be accused of "putting one over" on a nation that has broken up only 498,192 tons of dreadnought and pre-dreadnought construction, is puzzling to the common-sense mind of the average layman.

THE facts brought out in this article may serve to account for the failure of the Geneva Conference. Its futile ending is to be explained in large measure by the fact that the anti-treaty propagandists commenced their malicious work some weeks before the Conference opened, and continued at Geneva to carry it on most vigorously during the actual sessions.

We know that this is the case, because, before the Conference opened, we received from Geneva several articles from one of the most active anti-treaty writers, the burden of which was that the United States navy was already below Treaty strength.



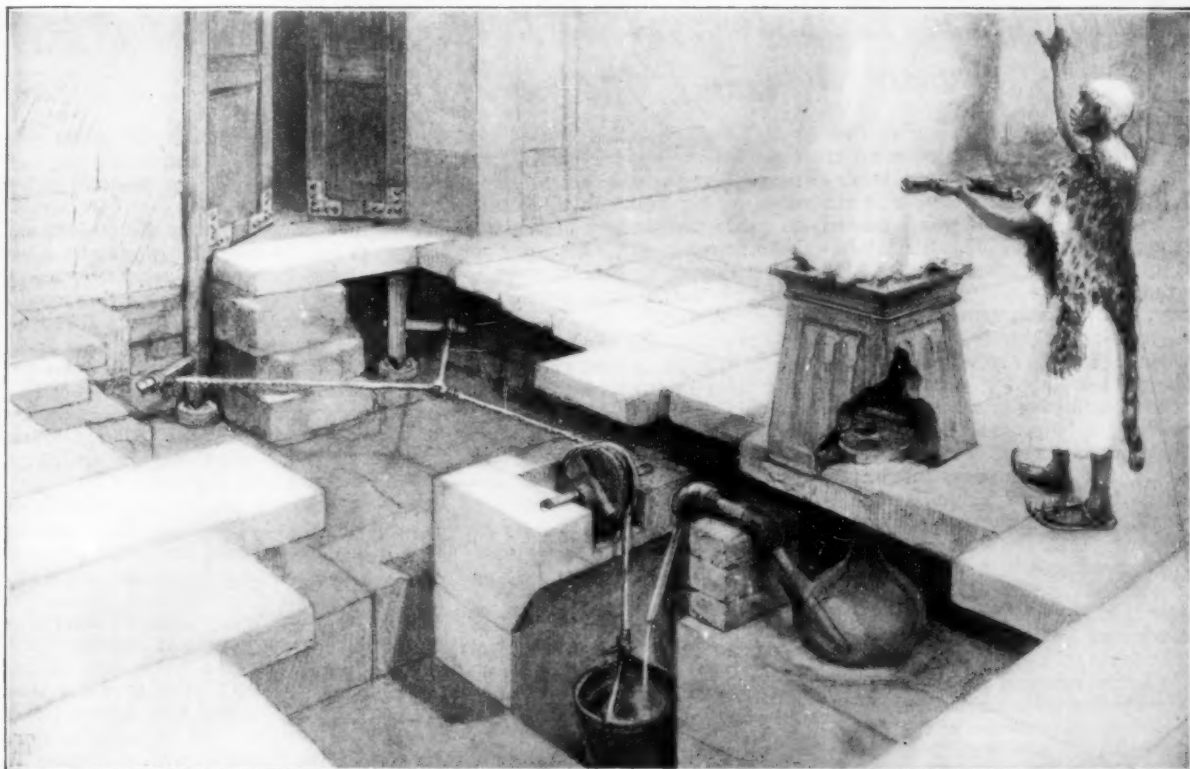
LATEST UNITED STATES DREADNOUGHT "MARYLAND"

Displacement 32,600 tons; armament eight 16-inch guns; twelve five-inch anti-torpedo guns. The 16-inch battery carried in four two-gun turrets, mounted two forward and two aft, giving better all-around fire than the Nelson

This endeavor to persuade the good people of the United States that we were the only country that made any real sacrifice is so wide of the mark as to be positively funny. No less an authority than Secretary Wilbur of the navy has stated before the

Happily, we have the assurance of our own and the British representatives at that Conference, that the discussions in the Conference itself were entirely friendly, and that the failures to agree contain no threat of disturbing competition.

Miracles Made To Order



Courtesy of The Illustrated London News

HOW ANCIENT EGYPTIAN PRIESTS IMPRESSED THE FAITHFUL

The temple doors open at the mere bidding of the priest! A miracle? To the gullible Egyptian of the period it must have seemed so. What, then, actually took place? The heat of the incense burning on the altar

warmed the air contained in its base, thereby expanding it. This in turn depressed the level of the water in the communicating jug below, and pushed some of it out into the counterweight, opening the doors

MR. WILLIAM REAVELL, President of the Institution of Mechanical Engineers, Great Britain, in a recent address on air compression, explained the two ancient Egyptian "miracles" reproduced here from *The Illustrated London News*: The statue at the right, one of the famous colossi at Thebes, 1450 B. C., saluted the sun by whistling. The two cavities A and B were separated by partition C. Tube D passed through top of partition. Both sides were filled with water, up to E. Air in A, warmed by the rising sun, depressed the water level, forcing water through tube into B, whose volume of water was thus increased. This compressed the air in cavity B, driving it up tube F to hidden whistles. Since time immemorial the unintelligent have tended to appraise the worth of religions by the ability of the priesthood to perform miracles. Conversely the priests understood that it was necessary, in order to insure the adherence of the masses, to meet this demand. This tendency occasionally crops up today.



"Old Ironsides" in Dry Dock

Placing the Badly Decayed "Old Ironsides" in Dock for Reconstruction—a Delicate and Difficult Task

THE United States ship *Constitution*, familiarly known as *Old Ironsides*, is now in dry dock at Boston for her fourth reconstruction since she was launched at the same port in 1797. She is without question the most famous ship in the annals of the United States Navy. None has a more brilliant record, and none, surely, is so safely enshrined in the affections of the American people.

The *Constitution* saw service in the French War, helped to clear the West Indies and our coast of the French cruisers, and a few years later bombarded the Fort of Tripoli and subdued the Barbary Corsair States. In the War of 1812 she won a succession of victories over British cruisers, which so increased the prestige of the United States that secession was averted and the war was brought to a close.

The fact that *Old Ironsides* is undergoing her fourth reconstruction testifies to the abiding place which she holds in the love and admiration of the Ameri-

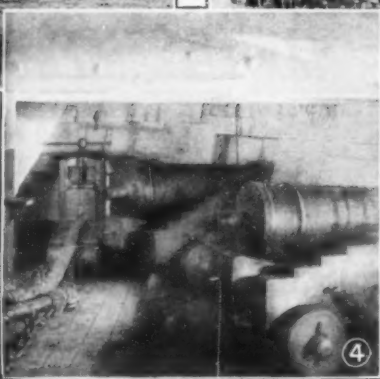
rebuilt. For this limited sum the *Constitution* was resparred and re-rigged, and some emergency work done on her hull. In the intervening 21 years the timbers of the hull had been so eaten away with dry rot and other decay, that only complete rebuilding would have saved the ship from oblivion.

The cost of this work is estimated at about 650,000 dollars, and in order to stimulate interest in this richly historical ship, it was decided to make an appeal to the school children and young people of the country for vol-

untary contributions. Sufficient funds are now in hand to start the work, and recently the ship was placed in dry dock.

Now it will readily be understood that since very little work was done upon the hull in 1906, and over half a century has elapsed since the second reconstruction of the hull in 1871, the whole structure must necessarily be in very poor shape. Dry rot has done its work only too well. It is possible to tear some of the timbers apart by hand, for they consist merely of an outer shell, filled with the friable material left by dry rot.

To place a badly decayed ship of the size and weight of *Old Ironsides* in dry dock was a task which caused the naval authorities no little anxiety. So long as the ship was afloat, the water provided a support that was evenly distributed throughout the hull at any given level; but in dry dock the bulk of the weight would rest upon the keel and bilge blocks. It was realized that unless additional



can people who are doing the work.

Her first reconstruction was done at Boston in 1833; the second took place in 1871 when she was rebuilt at the Philadelphia Navy Yard; the third, a partial reconstruction, took place at Boston in 1906. It was at this time that the good ship came very near passing out altogether, for the navy decided that since she was unsuited for any naval service, and was not worthy of repair, she should be used as a target and sunk by gunfire. This aroused such a storm of protest throughout the nation that Congress appropriated 100,000 dollars for her

"OLD IRONSIDES" IN DRY DOCK

1. Hull heavily shored up to prevent distortion. 2. Afloat in dry dock. 3. Removing the heavy masts. 4. Two 24-pounders on starboard bow. At left, original anchor stop

supports were provided, there would be danger of the hull settling so badly out of shape as to render reconstruction on the original lines of the ship a doubtful and extremely difficult problem.

Before the unwatering of the ship began, all movable weights were taken out of her. The heavy yards and masts were removed, as were also the heavy battery of some 50 guns, and other weights such as anchors, cables and gear. Then, as the water was drawn away, a veritable forest of shores was put in place, sufficient to prevent any distortion.

Do Insects Feel Pain?

Although Deprived of Parts of Their Bodies, Some Insects Seem to Feel No Discomfort

By HAROLD BASTIN

INSECTS are richly endowed with delicately adjusted sense-organs, some of which enable them to perceive phenomena that make no impression upon our own grosser nerve-endings. Ants, for example, can see the ultra-violet rays of the sunbeam to which we are blind. Again, the tactile sensibilities of many insects—especially sightless, cave-dwelling species—surpass our powers of comprehension. It has even been suggested that certain insects have a kind of touch language.

Yet all this notwithstanding, we are faced by the extraordinary fact—attested by many students of insect psychology—that insects do not feel pain. True, there is some evidence to support the view that they suffer varying degrees of discomfort, especially when their antennæ are

To this end he captured bumble-bees, and with scissors cut away all the front part of the head as far as the great compound eyes, including the antennæ and the mouth-parts, with their nerve-endings.

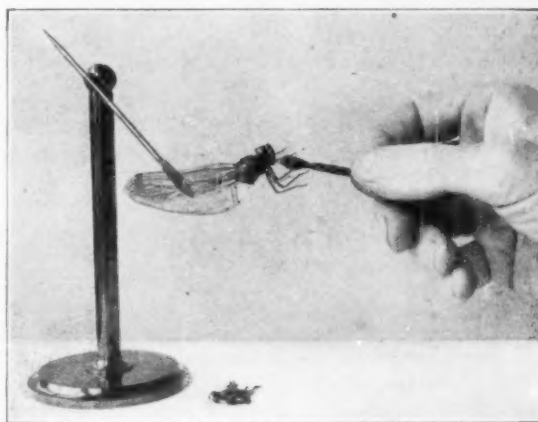
When liberated, the mutilated insects immediately flew to flowers in the garden and tried repeatedly to feed—vainly, of course, since they had been deprived of their mouths. Many of us may deprecate experiments of this nature; but it is obvious that we cannot urge against them the arguments that are usually employed by the convinced anti-vivisectionist.

The painlessness of the dragon-fly can be demonstrated with equal certitude. If we amputate the whole of its abdomen, the creature not only continues to eat, but its appetite becomes literally insatiable because no limit is now imposed by its internal capacity. The food, comminuted by its jaws, simply passes through the thorax and drops out through the opening of the truncated alimentary canal. The Rev. Theodore Wood mentions that a dragon-fly which, by an accident, had lost its abdomen, devoured in quick succession and with perfect calmness and self-possession some thirty blue-bottle flies, and finally disposed in the same way of its own severed body!

In like manner ants and wasps, whose abdomens have been cut off, will gorge themselves with honey or fruit syrup with every appearance of enjoyment—the sweet substance forming a glistening globule behind the severed peduncle, or “waist,” that is such a characteristic feature of these insects’ structure.

That an insect will eat, apparently with relish, when it is in process of being devoured by a carnivorous species larger than itself, is a well established fact. Thus, a dragon-fly nymph when making a meal of some lesser aquatic larva, may fall a victim to a water beetle. The nymph does not, as one might suppose, straightway relinquish its prey, but continues calmly to feed, with the beetle gnawing at it.

Every field naturalist can cap such instances by others drawn from his own experience. The common garden spider (not, by the way, an insect in the strict sense of the word) will feed



EATING ITS OWN BODY

The entire abdomen of this dragon-fly has been cut off, and the still living insect is eagerly devouring it. The particles merely pass through what is left of the insect and fall from the thorax as shown



IS IT IN PAIN?

The wings and abdomen of this wasp have been removed, yet it feeds greedily on a drop of fruit syrup. The syrup may be seen issuing from the truncated part of the alimentary canal, behind the thorax

pinched, or when strong corrosive substances are applied to their nerve-endings. But to pain, as we understand the word, they appear to be total strangers.

Should the reader be sceptical, the following instances will probably convince him. The late Auguste Forel, that painstaking investigator of insect sensitivity, desired to establish his belief that bees rely chiefly upon sight when they are searching for flowers.



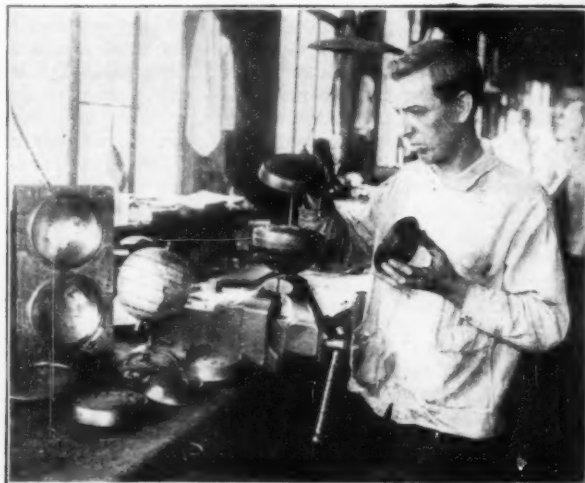
AND IT SLEEPS ON

The pin was passed through the body of a sleeping moth without awakening it

Inventions New and Interesting

Novel Devices in Many Fields of Application Show the Wide-spread Interests of Inventors

CONDUCTED BY ALBERT A. HOPKINS



SECTIONAL GLOBE TEACHES GEOGRAPHY TO CHILDREN

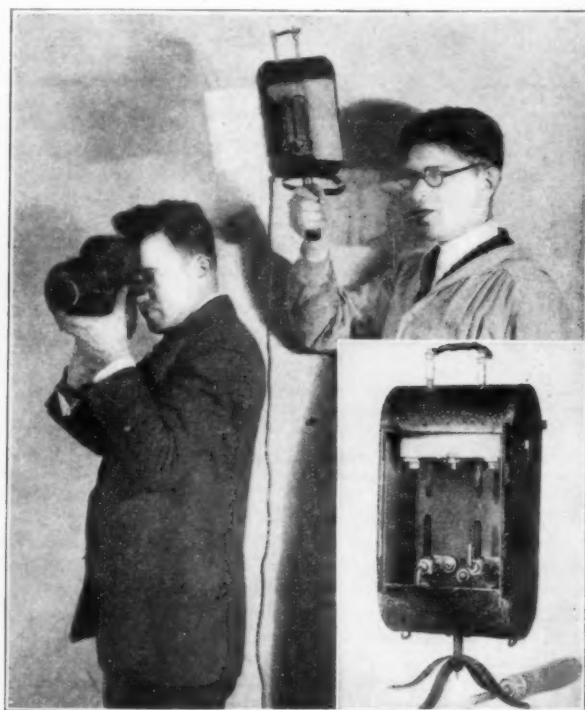
One of the recent educational toys to appear on the market is illustrated directly above. It consists of a globe of the world, the various parts of which are separable. The continents are all made in sections so that they can be taken apart, and each country on each continent is also

a separate block. When the parts are all assembled properly, a substantial globe results that can be used for reference, in just the same manner as any ordinary globe. In the right-hand illustration above is shown the factory in which these novel globes are made. Note forms used.



AIDS TO THE AMATEUR PHOTOGRAPHER

From Germany comes the pocket arc lamp for photographic use that is illustrated above. A small resistance screws in a lamp socket and governs the flow of current. The insert shows the details of the lamp and resistance.



Another portable arc lamp, made in this country, and resembling, when closed, a pocket camera, is shown in use and in detail above. It can be mounted on a small stand or held in the hand with perfect safety as is illustrated.



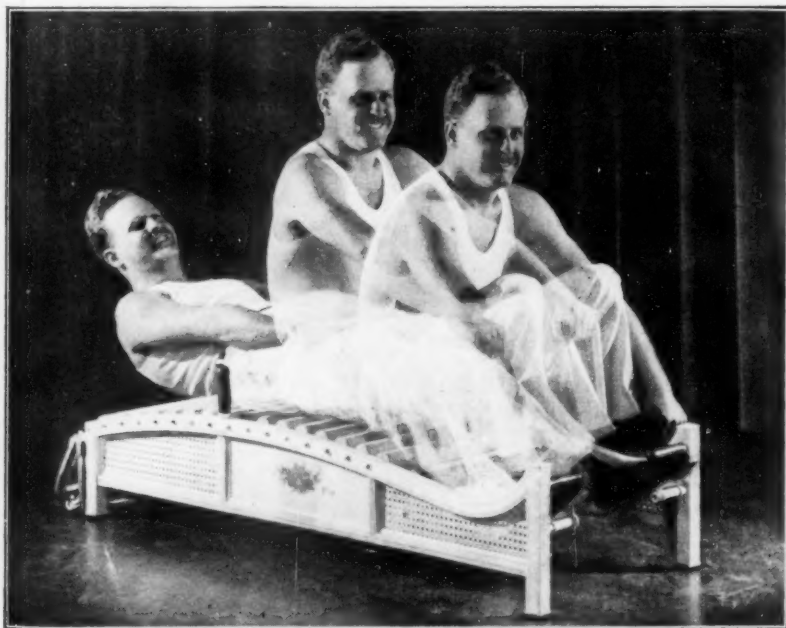
RUBBER BOAT CARRIES OUT-BOARD MOTOR

The rubber boat illustrated above consists of a thin yet strong rubber fabric which is cemented to the frame. The latter is made of a new rubber 'lumber.'



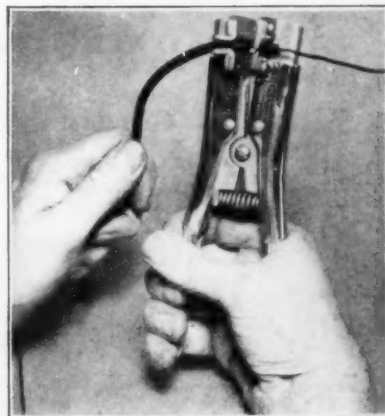
FOR BETTER VISION TO RIGHT OR LEFT

By placing the bows higher up on the frame of the spectacles, one manufacturer claims that the wearer will experience greater ease when looking to the sides.



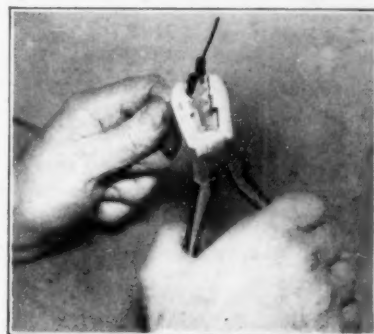
EXERCISING MACHINE INVIGORATES THE BODY

It is said that 15 minutes exercise with the above illustrated machine is very beneficial. The rotating rollers are of soft molded rubber and are filled with air.



▲ WIRE STRIPPERS

The device for removing the insulation from wire, illustrated above, is automatic in its action. The first pressing of the handles cuts the insulation, and further movement strips the covering. The pliers shown below are adjustable so as to cut any thickness of insulation ▼



PUTTING IT AWAY

The exercising machine illustrated at the left can be stored in a closet as shown

Household Inventions

Interesting New Devices That Are Both Useful and Time Saving to the Modern Housewife



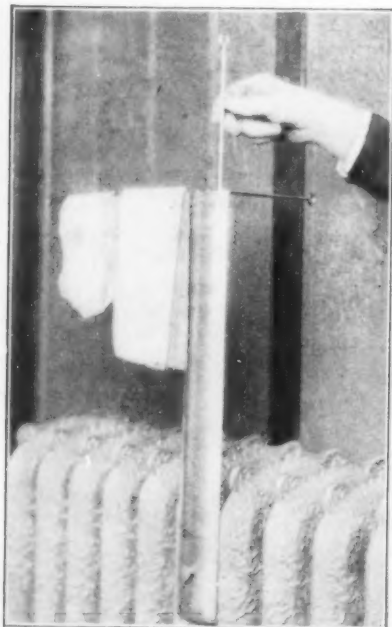
NEW REVERSIBLE ELECTRIC TOASTER

The toaster illustrated above shows a base carrying the heating element and supporting a reversible bread holder. After the bread is toasted on one side it can be turned over without the hands touching it or removing it from the grid. Directly under the heating element is a hinged tray which catches the crumbs



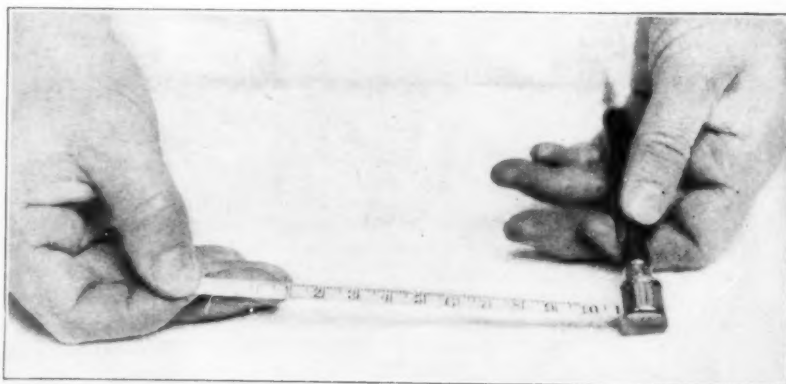
CLOTHES LINE HANGER

Does away with all knots and props. The line cannot slip, as the harder the pull, the tighter the clip holds. It is practical for both indoor and outdoor use



RADIATOR CLOTHES-HANGER

This rack will fit on any radiator, and can be used either in the home or office. The arms slide into the trough and the hanger can be placed in such a way that it becomes unobtrusive when not in use



▲ PENCIL AND TAPE-MEASURE

This combination tape-measure and pencil makes it unnecessary to carry around an extra rule. The tape-measure is on a reel in the top of the pencil. Pencil has a clip provided for conveniently carrying in the pocket, as shown in the above illustration



FRUIT-JAR HOLDER

With this device it is not necessary to wait until the jars are cool enough to handle before sealing. With the jar-holder and lid-wrench one can either open or seal the jar while still hot, at the same time protecting the hands from injury

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The Scientific American Digest

A Review of the Newest Developments in Science, Industry and Engineering

CONDUCTED BY ALBERT G. INGALLS

New System Controls Machinery by Sound

A NEW system of supervision and control by which operator-less machinery can be called up on the telephone and asked questions and given instructions, was demonstrated recently at the offices of the Westinghouse Electric and Manufacturing Company, in New York.

"This system, which is called the 'televocal' system, represents the latest step in the automatic operation of distant machinery," said R. J. Wensley, Westinghouse engineer, in explaining the device of which he is the inventor.

"By means of it, not only can a load dispatcher of an electric power company or street railway call up on any telephone unattended power plants or substations, receive reports on the status of every machine in the station, and start or stop machines, open and close switches, and perform other operations at will, but even the housekeeper could direct the operation of her home from the club or whist party.

"Automatic operation of electric machinery has been in use for several years, but all systems now employed require special wires run from the supervising point to the station.

Where stations are many miles away, numerous such installations may be very expensive. Telephone connections to all points always exist, however, and by using these lines for supervisory control, the cost of the control system is greatly reduced.

"It is against the rule of the telephone companies to connect extraneous wiring to the phones or to transmit over their lines anything except sounds within the register of the human voice," said Mr.



Underwood and Underwood

The inventor and the receiving end of the "televox," showing the relays that control the machinery which does the desired work

Wensley. "Hence, to utilize the telephone for controlling machinery, these regulations have to be observed. The problem was solved by using a series of sound-sensitive relays to make the switching connections at the control end, and operating these relays by telephoning to them different combinations of musical notes.

"It is theoretically possible to construct sound-sensitive relays that will respond to spoken words," continued Mr. Wensley,

"and to prove this point, we have at our East Pittsburgh laboratories a door which will open to the call of 'Open, sesame!' and to no other combination of sounds. However, such a system would be highly complicated to work out in practice, whereas by the use of only three notes of different pitches, we can secure any combination of operations desired."

The operation of the televocal system, or televox, as demonstrated by Mr. Wensley can best be understood if one were to listen in on a housekeeper at her club calling her televocally equipped home. She has three small pitch pipes, each giving a different musical note, and by means of these she asks questions and gives orders after being connected to her home.

HOUSEKEEPER to telephone central: "Give me 1234 Greenhill, please."

Operator rings that number.

Televocal system lifts receiver when telephone bell rings and housekeeper hears in her receiver a special combination of buzzes which is the signal from the televox that the right number has been rung.

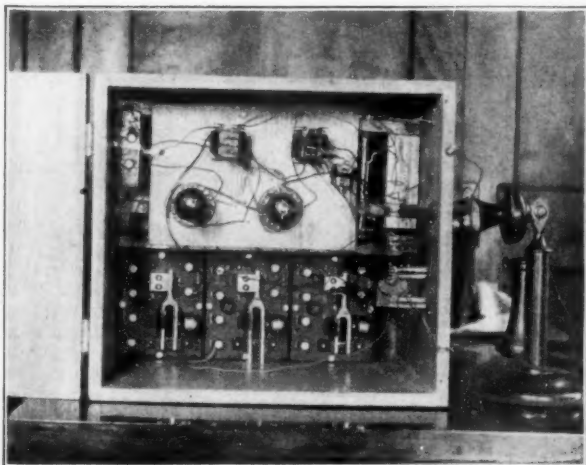
HOUSEKEEPER, with pitch pipe: "Peep!" which means, "Hello, get set for action."

TELEVOX stops buzzing signal and sends out a series of clicks, meaning "All set, what do you want?"

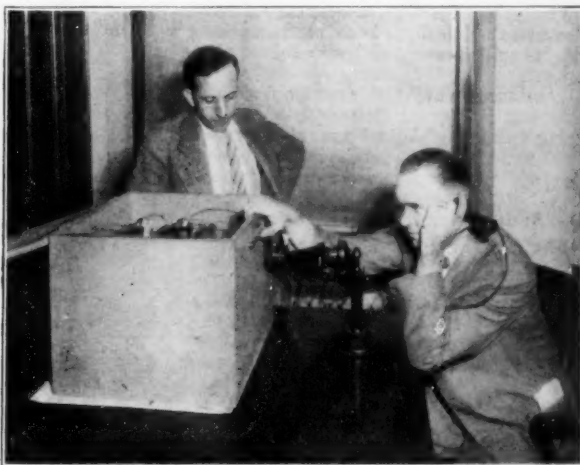
HOUSEKEEPER: "Peep, peep, peep," which means, "Connect me to the oven of the electric stove."

TELEVOX: "Buzz, buzz, buzz—buzz-z-z-z-z—" "You are connected and the switch is open."

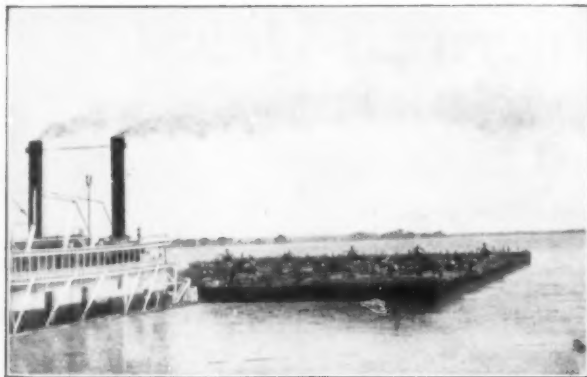
HOUSEKEEPER: "Toot!" which means, "Shut the switch and start the oven."



The transmitting component of the "televox." Tuning forks are the essential parts of the apparatus. These will vibrate only in response to their pitch



Commanding the "televox." The operator is pressing various buttons which actuate their respective tuning forks. This, as explained, issues "commands"



A Mississippi River steamer pushing four barges. Each one of these barges carries 36,000 barrels of oil, or more than a million and a half gallons



Loading the huge barges with oil. Unlike most cargoes, oil may be pumped aboard and discharged at the destination by the use of the same method

TELEVOX stops the long buzz, which was the signal that the switch is open, closes the switch, and then gives a short, snappy "buzz" to indicate switch is closed.

HOUSEKEEPER: "Peep, peep, peep, peep," which means, "Connect me to the furnace and tell me how hot it is."

TELEVOX: "Buzz, buzz, buzz, buzz—buzz, buzz"—Four buzzes mean, "You are connected to the furnace;" two following buzzes mean, "It's pretty low."

HOUSEKEEPER: "Peep, peep, peep, peep, peep"—"connect me to the draft operating switch."

TELEVOX gives five buzzes and then a short one, meaning, "You are connected to the furnace draft switch and the drafts are closed."

HOUSEKEEPER: "Toot!" or, "Open the drafts!"

TELEVOX opens the drafts and gives a long buzz, "The drafts are open."

HOUSEKEEPER, blows her third pitch pipe, which means, "Good-bye."

TELEVOX hangs up receiver.

This series of operations was explained by Mr. Wensley as follows:

Sounds that come over the telephone to the televoval apparatus are received from the receiver by a sensitive microphone, and the buzzing signals made by it are given out by a loud speaker close to the telephone transmitter. Hence, no electrical connections to the telephone are needed, and nothing but sound is received from it or given to it.

When the bell rings, a sound-sensitive relay lifts the telephone hook, starts up the station-signal buzzer, and sets the whole apparatus ready for action.

By means of a high note (produced at the demonstration by an electrically-operated tuning fork) any desired one of any desired number of relays is brought into play. By sounding the note twice, relay number 2 is connected; by sounding the note three times, relay number 3 is connected; and so on indefinitely. The operator must, of course, know his relays, and call for the particular one desired.

Suppose he calls for number 3, which is one that will open or close a certain circuit breaker. When this relay is connected in circuit, the televoval device gives three buzzes, reporting that number 3 relay is ready, and then either a long buzz or a short one, indicating the circuit breaker it controls is either open or closed, as the case may be.

Then, with everything set, the operator sends out a note of a lower pitch, called the "operating note." This causes the relays to

act so as to reverse the condition of the breaker, closing or opening it, as the case may be, and reporting the fact by changing its long buzz to a short one, or vice versa.

If the operator calls for a relay that is connected to a water level device or a thermometer, the relay, when connected, will read off the water level or temperature by an appropriate number of buzzes. Then by calling for another relay, the operator can cause whatever action may be needed according to the information he has just received.

In this manner, almost any desired information can be secured or operation performed.

The sounds when received by the televoval apparatus are passed through filters so that all but exactly the selected pitches are eliminated and extraneous noises are prevented from causing operation of the relays.

If the televoval system is called, it will repeat its buzzer signal for about a minute and then hang up unless it receives the special high-pitched note that is the signal it is wanted and should set itself for operation. Hence, if called by accident, it will hang up automatically after a minute's buzzing without taking further action.

When called into action, it will keep the circuit open indefinitely until it receives a special low-pitched note, which is the "good-bye" signal and causes it to hang up and go out of action.

Under ordinary circumstances, mechanically-operated sound-producers are em-



This unusual type of revolving fire-hose nozzle for fighting ship fires is described at the right

ployed, but a musically gifted operator can secure information from the televoval by whistling or singing at it.

Distance is no barrier to the operation of the televoval system. An operator in

New York could control machinery in San Francisco, Cuba, and England—the transatlantic radio link being used in the last instance.

The telephone instruments employed are not altered in any respect and may be used in the ordinary way whenever wanted.

Modernizing the Mississippi

ALTHOUGH public attention has recently been centered on the Mississippi River, little has been published concerning some lines of modernization which are rapidly affecting the old manner of handling traffic. Caterpillar tug-boats, modern rust-proof steel barges, and more recently enormous oil barges are some of the latest trends.

The development of the oil fields in Texas and Oklahoma has added another line to steamboat traffic on the Mississippi. Oil shipments on the great inland waterway are made in tank barges—flat-bottomed boats of large capacity. A single steamer—in our illustration it is an old type stern paddle-wheeler—pushes four loaded barges, each with a carrying capacity of 36,000 barrels. Thus one tow will transport more than a million and a half gallons of oil.

The barges are loaded and discharged by pumps installed aboard the barges, so that the conveyance of the cargo is very "flexible."

To Fight Unseen Fires

IN firefighting, one of the most tricky and difficult fires to reach is that between decks or in smoke-filled cellars.

To meet this situation, the Heffernan Multiple Nozzle Distributor was designed and has proved so efficient that the designer received the New York Fire Department administration medal for 1926.

Six smooth-bore nozzles set in a circle, equi-distant on the horizontal plane, with each nozzle placed at a different angle in a vertical plane, freely rotate together around the axis of the hose coupling. This provides that every point within reach of the stream will be covered in an upward circular direction; the water falling from these streams extinguishing the fire below. Two other five eighths inch nozzles can be elevated or lowered to regulate the speed of rotation of the distributor; for, to be efficient it has been found that the nozzles should revolve slowly in order not to break up the streams. Thus, larger streams can be thrown greater distances. The distribu-

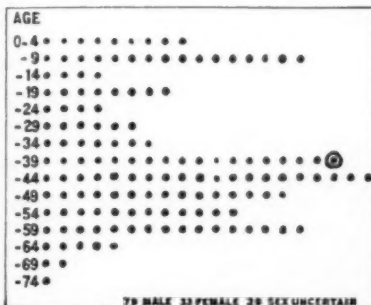
tor is lowered into the fire area by the hose which attaches to the coupling shown.

It is estimated that, siamesed to two pumping engines, at 150 pounds pressure, from 1200 to 1400 gallons of water per minute can be discharged and an area of 14,500 square feet can be covered.

Do We Live Longer Nowadays?

THE popular belief that "in olden times people lived to a ripe old age, while nowadays they die at a younger age," is blown sky high by some interesting research performed by Prof. T. Wingate Todd of Western Reserve University, and described in the *Scientific Monthly* (New York). The evidence of ancient burial places, in the form of the actual skeletons of the deceased of various periods, demonstrates clearly that in spite of the widespread notion to the contrary, relatively few people formerly lived to be old, and that even in our day among primitive tribes, despite what some imagine is "the normal healthy life of a savage," most human beings fail to live past the 40 year mark.

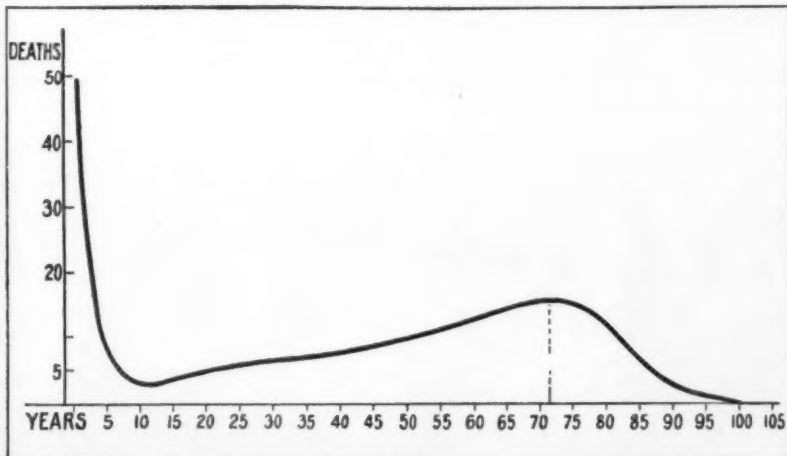
Having gained permission to excavate



Courtesy the *Scientific Monthly*

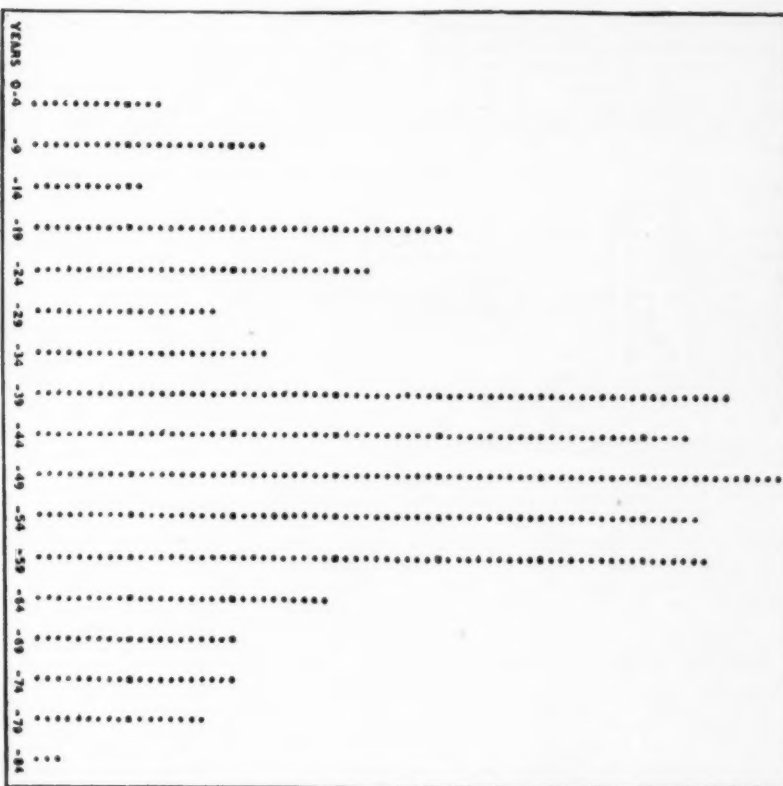
Mortality graph based on skulls and skeletons from a medieval English community. The dot representing median age is encircled

in an ancient burial place, the modern anthropologist has little more difficulty in determining the age at death of each skeleton encountered than the horse trader has in judging a horse's age from its teeth. The bones of the human body undergo constant change, not merely during the long period of growth but through-



Redrawn from the *Scientific Monthly*

Analysis of the curve of death of 1000 modern English males. This curve brings out the "peak of old age death" which comes at about 70. We do not live longer now than many formerly did, but a far larger proportion of us now live to be old. Statistics must consider high infant death rates



Courtesy the *Scientific Monthly*

Mortality graph based on estimates of remains from Pecos site in New Mexico. Here there was evidently a chance to survive longer, as indicated by the number of remains of individuals ranging from 39 to 59 years of age

out the remainder of life. Explaining how the estimates are made, Prof. Todd writes:

"The life history of the skeleton from adolescence to senility can be outlined in the following manner:

"From adolescence to the age of 25 years, union of epiphyses is the dominant feature.

"From 25 to 30 years, closure of sutures continues the tale along with the consolidation of areas, like the symphysis pubis, which possess rudimentary epiphyses.

"From 30 to 35 years, the skeleton is at its prime and there is a lull in differentiation. Sutures not yet fully closed mark time, having lost their impetus to unite.

During this period the muscular system and the cerebellum, the coordinating mechanism for muscular control, begin to show deterioration.

"Such deterioration becomes indicated in the bones between 35 and 45 years, as an intensification of the sites of muscular attachment and as the formation of rims, not lapping, at the articular margins. The so-called muscular markings on bone are not an indication of muscular development and strength but appear when the muscular system is on the downgrade, long after the time when current hypothesis would call for their maximum development.

"From 45 to 50 years, preparation is being made for the far greater changes occurring after 50: the final rims are developed and the smooth and polished surface texture of earlier years begins to give place to a more granular appearance which after 50, first in ribs and vertebrae but later spreading to all parts of the skeleton, is associated with a peculiar modification of bone substance which we describe as a cinder-like texture.

"Between 50 and 60 years, the surface erosions progress, but from 60 onwards they may be more or less stationary although the cinder-like texture becomes more pronounced."

Given, then, an authenticated and representative collection of skeletal remains of any known period of history or prehistory, the anthropologist can deduce considerably more about living—and dying—conditions in that period than might at first thought be supposed; the study constitutes, in fact, a sort of "posthumous census" of the particular age in question.

Professor Todd's first example is not, however, from skeletal remains themselves,

but from gravestones. In a Roman colony of the early Christian centuries these stones, still in existence, were marked with the birth and death dates of the deceased. From this evidence and from some gathered in Africa and Spain, it has become obvious that in the days of the Romans, the peak of

Next, from a superb collection of 594 skeletons excavated at Pecos, New Mexico, by Dr. A. V. Kidder, covering a range from 800 A.D. to 1800 A.D., it becomes evident that while the median age was in the early forties, old age showed no peak as it does today. Over the thousand

ments of its eyes, and are mounted in special blinders, as shown in one of the accompanying illustrations.

Extensive experiments were carried out at the E. R. Bradley stables at Lexington, Kentucky. Several horses with faulty vision were equipped with glasses. The animals did not object to the strange device strapped over their eyes. Instead, they immediately gave indication of being able to see better. Tests showed that the glasses served to reduce their running time an average of one second for each quarter mile. In some cases a reduction of nearly three seconds was made. Horses which were formerly so nervous as to be hardly mountable, and which could see scarcely three feet, were rendered gentle by spectacles. The most important result, however, of the newly developed method of testing vision is not the fitting of glasses, as Dr. Emons points out. Instead, the proper diagnosis of trouble will permit the breeding of mounts in such a way that poor vision, which is hereditary in horses as well as in man, will not be transmitted. Eventually this should result in the development of a better class of horses.

A problem of national defense is also involved in this interesting work. Cavalry horses must be as perfect as possible, but in the past practically no attention has been given to the condition of their vision. For greatest efficiency, each horse should have nearly perfect eyesight. Careful breeding with a knowledge of the condition of the eyes will, it is believed, result in a superior brand of cavalry mounts.

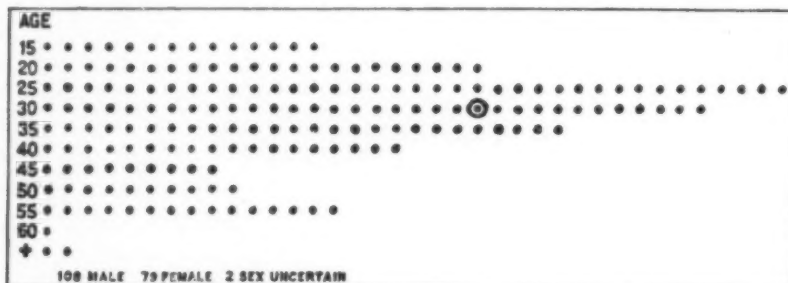
The fitting of glasses to horses recalls similar experiments tried several years ago with athletes. At first the idea was not accepted very enthusiastically by the sporting world, yet many of the outstanding athletes of our day have won their laurels largely as a result of wearing spectacles to correct the ocular faults which would otherwise have rendered them relatively unfit for athletic competition.

Record Mineral Find Likely to Lower Price of Borax

BOTH borax and the variety of glass known as "Pyrex" are likely soon to become much more common owing to the recent discovery in California of a very large natural supply of a borax-bearing mineral called "rasorite."

Although "Pyrex" is a trade name, everyone now knows about it, especially because Pyrex glassware is regarded by most housewives as superior to ordinary

(Continued on page 550)



Courtesy the Scientific Monthly

Mortality graph based upon age estimates of skulls of West African negroes. Each dot on this chart represents skull of an individual; circle, median age

the deaths took place as early as between the ages of 20 and 30.

Professor Todd next shows that modern dissecting-room material, representing in the main a class of people who are denied the security of life and comfort of living characteristic of our civilization, live to the median age of 45 years—nearly 20 years longer than the Romans mentioned above; negro material of the same sort runs only to 33 years, due to the fact that death among negroes, even in civilization, occurs relatively early in life.

A large collection of West African negro skulls of modern date gave the results shown in an illustration reproduced in these columns. The median age indicated by the circle surrounding one of the dots falls at 30. Likewise, a collection of the skulls of Tasmanian aborigines—a most primitive race which is now extinct—shows that "the majority of deaths took place about or before 25 years."

Next, Dr. Todd examined the remains of some skeletons exhumed from a Bronze Age burial place in Great Britain. The evidence is that these people's age at death ranged from 17 to 30 years, none being older than this!

Coming up to the Middle Ages—the 11th, 12th and 13th centuries, with 143 skeletons from a cemetery in England—a figure here reproduced shows 39 to be the median age and indicates the existence of no peak of old age, such as may be found today in civilized communities. "We must conclude," says Prof. Todd, "that few individuals reached advanced years."

years represented by this series, there is no indication that life to old age was anything but an exception.

Such is the evidence from which Prof. Todd concludes that "the peak of old age death, so prominent in modern mortality curves, fades into insignificance the further we recede from the present day, and in the dimmer records of the distant past we find no real indication of its existence." The chief difference between ancient as well as modern primitive populations and civilized populations of today, he states, "is the apparent fact that the peak of old age death is a comparatively modern achievement resulting from the greater safety and improved conditions of living."

Horses That Wear Spectacles

SPECTACLED horses that run faster and more consistently than their rivals may soon be a common sight at race tracks, since a method of testing the eyes of race horses and fitting them with eye glasses has been worked out by Dr. Ernest E. Emons of Akron, Ohio.

No horse can make use of the vision charts which the oculist uses for testing human eyesight, so Dr. Emons devised a way of testing their eyes by means of a powerful light and special instruments. The results of hundreds of examinations revealed that approximately 10 percent of all race horses suffer from defective vision.

Once the eyes of a horse are tested, lenses are ground according to the require-



Dr. E. E. Emons testing the eyes of a race horse with a special ophthalmoscope he has devised



A race horse equipped with glasses which were designed after tests had been made by Dr. Emons

Learning to Use Our Wings

This Department Will Keep Our Readers Informed of the Latest Facts About Airplanes and Airships

CONDUCTED BY ALEXANDER KLEMIN

In charge, Daniel Guggenheim School of Aeronautics, New York City

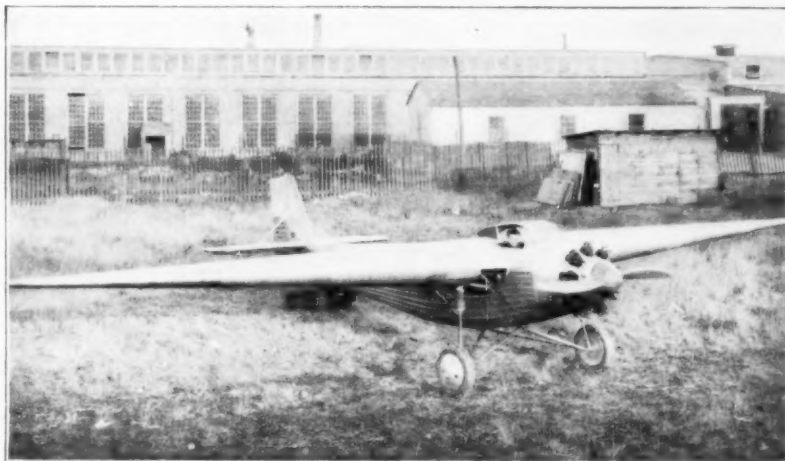
All-Metal Cabin Plane

SMALL commercial airplanes are being built in increasing numbers all over the United States, particularly around the famous Wright "Whirlwind" engine. Just as is the case with automobiles of the same horsepower and for similar purposes, such planes tend to a family resemblance. Witness the Bellanca monoplane, the Ryan monoplane which Lindbergh used, the Stinson *Detroiter*, and the Fairchild *FC-2*. The Hamilton cabin monoplane, recently tested out, belongs to the same class of craft, being equipped with the Wright "Whirlwind" engine and carrying four passengers in addition to the crew. However it offers many departures from what is almost accepted practice for ships of this size and purpose.

It is built entirely of duralumin, with a thin sheathing of the same metal, and is one of the smallest planes ever built in the United States embodying such construction. The bracing struts from the fuselage to the monoplane wing are dispensed with. Instead, the wing is made to taper from root to tip, in both plan and elevation. At the root there is, therefore, a very deep and wide wing section to take

up the heavy bending moments. Instead of the customary two spars inside the wing, running along its span, three spars are employed. While this makes the structure somewhat more difficult to calculate, it also gives the possibility of lighter construction than with two spars.

inches; height, eight feet, three inches; weight empty, 1858 pounds; useful load, 1200 pounds; maximum speed, 120 miles per hour; landing speed, 48 miles per hour. Altogether this is a very useful plane for use in connection with airmail feeder lines and for taxi work.



A view of the all-metal monoplane described in these columns



Herbert Photos

A successful method of delivering typewriters by airplane has been demonstrated at Curtiss Field and other airports. Three Royal Typewriter machines, carefully packed in a large case, were released from a Ford-Stout all-metal monoplane as it flew over the field, and were wafted gently to the ground, via parachute. This may suggest an idea for clever advertising, but there is no reason why the delivery of various commodities should not be expedited by the airplane, coupled with a parachute

In the mounting of the engine, the designer seems to have arrived at a very neat form of cowling and spinner so that the bow of the ship presents a well streamlined appearance. The two 40-gallon tanks are placed in the wings on either side of the fuselage, well out of the way of the engine in case of a crash, and high enough above the carburetor to give pure gravity feed. The constructors have frankly gone to a very wide (nine-foot) tread, useful in preventing sideways tipping on the ground. Shock absorption is provided by two struts which go vertically up to the wing, with shock energy taken up by rubber disks in compression.

In the passenger and pilot accommodation, some interesting points emerge. The cabin windows are in the wing stub instead of the side of the fuselage. The wing stub is so built into the upper portion of the fuselage that the cabin is eight feet wide above the seats of the four passengers. With an arm rest, the occupants thus have unusual comfort and elbow room. With the very deep wing at the center section, the fuselage disappears partially into the wing itself. The streamline enclosure for the two pilots is itself streamlined to wing contour. There may be aerodynamic advantages in such design. The inclusion of dual control is valuable for all around purposes. In rear of the passenger cabin is a compartment of 70 square feet in which mail or freight may be carried.

The specifications of the plane are span, 48 feet, five inches; length, 31 feet, five

Bonney's "Gull"

Leonard W. BONNEY is an "old timer" in the aviation game. He was taught to fly by Orville Wright in 1910, and has been flying ever since as a test pilot and civilian instructor. Of an inquiring turn of mind, he caught sea gulls, made plaster casts of their wings, and after two years of work has produced a machine on very unconventional lines. The flight tests have been delayed by engine troubles and other difficulties. They are being awaited with considerable interest. Opinion is divided as to whether the new machine is a hopeless freak, or a real step forward.

One of Bonney's aims is to produce a craft which will land with a short run. By a hydraulically operated mechanism, he is able to change the angle of incidence of the wings (as shown in the photograph) on landing, so that all the lift, or most of it, is lost and a maximum resistance is offered to forward motion. At the same time, since the lift is lost, the full weight of the plane rests on the ground and the wheel brakes are rendered more effective. The resistance of the wings balances the resistance of the brakes so that any nosing-over tendency is avoided. In any case, the provision of a third wheel at the tail instead of the conventional tail-skid enables the center of gravity to be placed back of the front wheels, which in itself should prevent nosing over.

The brakes can be applied simultaneously or separately on either wheel; in con-

junction with a steerable third wheel perfect control in "taxying" should be obtainable. By a further application of hydraulic control, the wings can be swung back as well as down—in other words, the wings can be "folded back" rapidly, so as to park in a hangar only 15 feet wide. The rear part of the wing is hinged relatively to the front part and the camber or curvature of the wing varies automatically.

At high speeds the curvature is small, so that the wing profile is a high speed one; at low speeds the curvature is large, and the lifting capacity is increased accordingly. This automatic variation in camber is the feature which we would question the

The Operator's Viewpoint

THE Western Air Express operating between Los Angeles and Salt Lake City is one of the best operated air lines in the United States and is said to be making real profits. The views of its able president, M. Hanschue, as expressed in a recent paper on "Commercial Aviation From the Operators' Viewpoint," are therefore authoritative. These views are particularly timely when so many new air lines are in process of organization.

The airplane, as a transportation vehicle, has limitations. At present it has little value save where it serves two major

as the mail, and it is doubtful whether passengers could pay rates equivalent to the carriage of mails. Ultimately, the operator's business will be a combination of mail, express, and passengers. For the time being, the mail looms very largely in his calculations.

The Post Office Department under the Kelly Bill can grant contracts for air mail, but at the same time it is obliged to ask for bids. The tendency nowadays is to bid dangerously low. The low bids come, not from experienced companies, but from new entrants into the field. From such low bids, a serious danger will arise to the entire industry.

Mr. Hanschue advocates very wisely that the Post Office should not let contracts at a price which will not return revenue sufficient to maintain adequate operation. We heartily agree. Some companies



Wide World.

most. The profile and plan form of the wing is such as to be extraordinarily efficient, the shape of the tips seems to be such as to decrease end losses. There are no ailerons such as we are accustomed to see. The outer portion of the wing on either side can swing into the fixed portion and back, (see the underside of the front view of the craft). This lessens the moment arm of the outer portion, and lateral control results.

Possibly such an arrangement may remove the tendency of the usual ailerons to wing a machine off its course. The portion which swings back will lose efficiency by the breaking of the plan form, and so the resistances on either side should balance.

Further, with ordinary ailerons and at high angles of incidence, there is loss of control. When the front part of the wing is at a large angle, turning down the aileron does not produce the desired increase in lift, and control is lessened thereby. In the "Gull," when the outer portion is turned back, control will always remain, no matter at what angle the wing surface is inclined to the wind. The elevators may be spread in flight by the pilot, as a black-bird "fantails" while on the wing. This has the advantage that it may be possible to alter the stability characteristics of the plane at will. The chassis is worthy of note. It is entirely of the cantilever type, with no wires or struts exposed. See particularly the illustration above.

We are inclined to think that Bonney has thought on original lines, and that his objectives are valuable. Whether the complexities of the mechanism will be successfully overcome, and whether such complexities are worth while, in actual practice, remains to be seen.

Left: Side view of the new bird-like plane, with wings in flying position



Wide World.

Right: Showing how the wings of the "Gull" are folded for parking

communities separated by distances not traversed by a slower and cheaper medium overnight. An exception to this rule is afforded where two communities have overnight train service, but where the airplane can relieve emergency traffic and give special service by a round trip in the course of one business day.

Regularity of performance is essential above everything else. The regularity of performance of American air lines now ranges between 90 and 99 percent or more. But only where mechanical performance is at its highest is steady patronage by the public assured.

Modern equipment is excellent; far better than is generally assumed to be the case. But planes selected for a given route must have sufficient reserve of power to fly under all conditions without being forced to their physical limit. Furthermore, there must be a sufficient reserve of aircraft to meet all contingencies.

The present rate on airmail to the user is 10 cents per half-ounce or fraction thereof; that is, \$3.20 a pound anywhere in the United States. This blanket rate is arbitrary but, presumably, it yields the government an average between the long and short haul, and between bulk mail and letter mail sufficient to pay the airmail contractors. The lightweight letter mail generally runs 40 to 50 letters to the pound, and therefore yields four to five dollars per pound to the government. Express matter would be quite expensive to the user if it had to yield the same amounts per pound

are even now showing dangerous and continued losses. It also follows that the Post Office Department should not yield to local pressure and ask for bids over routes where geographic and economic conditions are such as to preclude a reasonable volume of business.

The organization of an air line should be preceded by a serious and unbiased survey. It should be determined whether the route presents any serious natural barriers—under the headings of topography, weather and air navigation facilities. The type and size of airplane best suited to the proposed operation; the number of planes required to maintain a high standard of service; the costs of operation; depreciation; the costs of insurance coverage; all these factors must be carefully considered. Above all the possible volume of traffic must be studied.

Hanschue has some wise words to say about financing. "Original financing should provide a reasonable cash surplus above actual costs of installation. There should be no promotion stock issued nor any commission paid on stock sales."

Personnel should be selected on ability rather than on a salary basis, for only expert pilots and mechanics can be employed if there is to be hope of success.

There arises in air line economics an interesting financial point. A commercial air line has a comparatively small proportion of its investment in elements of fixed cost. It requires no road bed. Its airway

(Continued on page 563)



INDUSTRIES FROM ATOMS

*A Department Devoted to the Advancements Made
in Industrial and Experimental Chemistry*

CONDUCTED BY D. H. KILLEFFER

Mechanical Improvements in Drug Manufacture

POSSIBLY many of our readers remember the old nursery rhyme which goes in part as follows:

Miss Mehitable McFlimsey
Had a very funny whimsy
Of crying when she had to go to bed
Said the Bed, "It is a pity
To see you crying 'Hitty,'
So after this I'll come to you instead."

An adaptation of the idea of Miss Mehitable McFlimsey's bed has been applied to the manufacture of drugs. In the plant of the Eli Lilly Company, Indianapolis, the constant moving of supplies around the plant has been done away with by mounting on a continuous conveyor the percolators in which fluid extracts are prepared. The operator is stationary at a point where all the supply lines converge and the gigantic percolators over which he has supervision are moved about in an elephantine procession, to be charged and discharged as required. Other mechanical improvements have greatly reduced the labor requirements and the chances of error in drug manufacture in a recently built addition to this plant.

X-Ray Studies of Lime

THE application of the modern developments in the use of X rays in crystal analysis may lead to valuable results in improving the quality of lime used in plastering. A study of this field was reported to a recent meeting of the American Chemical Society by Dr. Marie

Farnsworth of New York University, who found that X-ray methods may be depended upon to furnish accurate data as to the plasticity of lime samples. Dr. Farnsworth found that the ideal lime from a plasticity standpoint is produced by burning marble in a vacuum. An X-ray spectrograph of a sample of this lime is shown in the accompanying illustration. By comparing X-ray spectrographs of lime as manufactured with an ideal of this kind, it may be possible to improve greatly the quality of the output of the plant.

A New Metal Cleaner

IN manufacturing para-dichlorobenzene, large quantities of its undesired brother, ortho-dichlorobenzene, are produced. Although the para compound is required both by industry and as an insecticide and fungicide, the ortho compound has found very little use. It is necessarily produced to the extent of about a million pounds a year and hence the finding of a profitable use for it is important.

Messrs. Groggins and Scholl of the Color Laboratory of the Bureau of Chemistry have been studying the problem of utilizing this unwanted material and have found it to be an excellent solvent for the tarnish on most metals. The material is very cheap and readily dissolves the oxides making up the tarnish on copper, silver, and nickel. It may be used as produced or it may be mixed with mild abrasives such as chalk to make a paste of it for use in the home. The investigators carried out experiments with a liquid cleaner containing one part of

chalk to five parts of ortho-dichlorobenzene and obtained extremely satisfactory results in polishing metals with it. The material does not attack the metal itself.

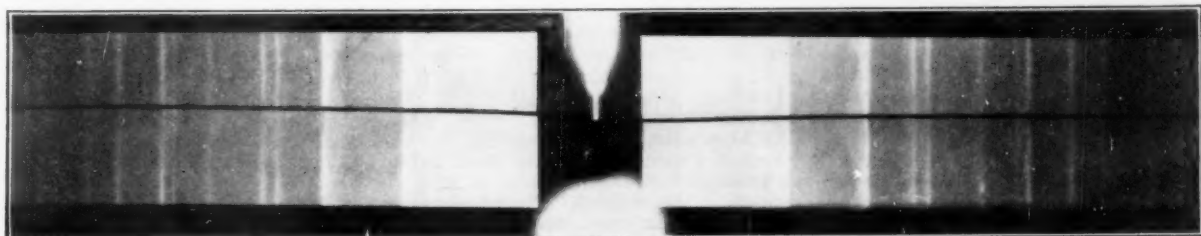
New Primary Cell

THE Swedish chemist H. D. Nyberg has invented a primary cell involving some new features. In this cell porous carbon is used as the container, acting at the same time also as a depolarizing electrode. The carbon is impregnated with paraffin wax in such a way that it is completely impermeable by the electrolyte but allows the diffusion of air through its pores in sufficient amounts for depolarization. The electrolyte is mainly a 10 percent solution of sodium hydroxide, and the soluble electrode is zinc amalgam containing $\frac{1}{2}$ percent of mercury. The Swedish Junger Storage Battery Company, which has obtained a license for the exploitation of the patents in all countries except America and Australia, has started the manufacture of the new batteries.

Synthetic Clothing

MODERN woman would not be disturbed at all if the supply of natural textile fibers were entirely cut off, according to Prof. Pauline B. Mack of the Pennsylvania State College, addressing the Institute of Chemistry of the American Chemical Society at State College, Pennsylvania.

"The creative chemist has produced synthetic fibers suitable for the produc-



X-Ray spectrograph of lime produced in a vacuum at 1800 degrees, Fahrenheit

tion of textile fabrics of unusually artistic beauty," Mrs. Mack said, "and dresses for every conceivable occasion can be made entirely of manufactured substances. By placing these artificially produced materials on the market at low prices, more has been done toward making a democracy of all peoples of the world than by any other single agency."

During the course of Mrs. Mack's lecture, Miss Elizabeth Wagner of Morgantown, West Virginia, a member of the Institute of Chemistry, was presented as a model of a modern bride "clad from head to toe, except for the soles of her slippers, in synthetic materials." "Her dress was made of rayon fibers, trimmed with rayon lace," Mrs. Mack said.

"The sleeves are of cellulose acetate

fabrics for sport wear, charming color effects made by combining two kinds of rayon with different dyeing properties, and dresses and shawls embroidered with lustrous rayon threads, hats of rayon, of rayon plush, or of cellophane, beads of collodion, of glass, of casein, or of bakelite; all these and more are easily to be had."

Is Ethylene a Ripener?

SOME time ago in this department Dr. R. B. Harvey, of the University of Minnesota, was quoted as stating that "unripe fruits could be quickly ripened at will by exposing them to an atmosphere containing a small proportion of ethylene." Investigations carried out by Messrs. Chace and Church of the Laboratory of Fruit and Vegetable Chemistry, United States

The Commercial Solvents Corporation, to utilize a mixture of approximately equal volumes of hydrogen and carbon dioxide obtained as a by-product of its fermentation operations, has developed a process for converting the mixture directly to methanol. Lazote, Inc., is utilizing the methanol reaction to remove carbon monoxide from the nitrogen-hydrogen mixture obtained from the water-gas reaction before using it in the Claude ammonia converters. The increased purity of the gas mixture thus obtained and the value of the methanol produced make the purification a profit-producing operation instead of a mere expense, and thus the cost of ammonia synthesis has been somewhat reduced.

A Cheaper Mechanical Refrigerator

ALTHOUGH there are many types of mechanical refrigerators now on the market and in successful use, frequent announcements are made of new types claiming advantages over those now available. According to a dispatch to the American Chemical Society from Norway, a new apparatus that is both cheap to buy and to operate has been perfected by a Norwegian engineer, Ivar Amundsen.

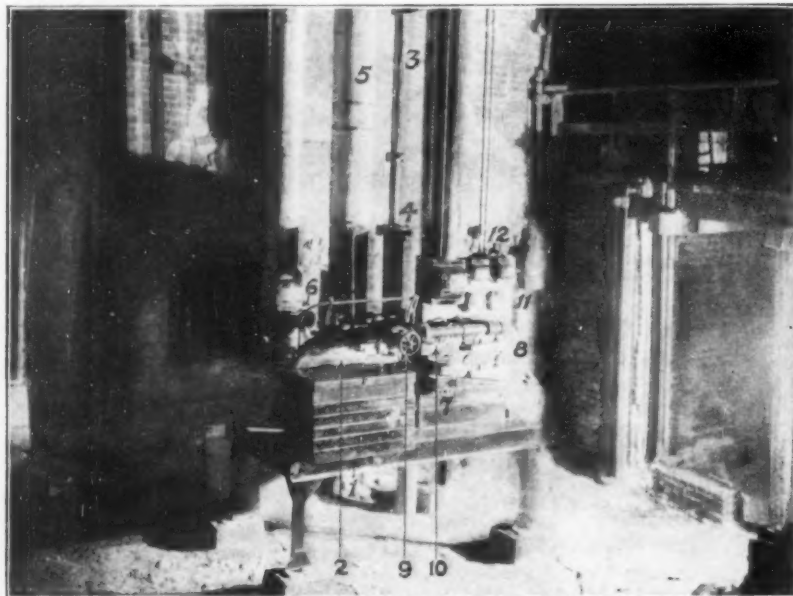
His apparatus is based on the absorbent power of activated carbon, the cooling substance being methanol or ethyl alcohol. The apparatus is filled only with activated carbon and a limited amount of alcohol under a pressure below the atmosphere pressure, the weight and dimensions of the apparatus being quite small. A refrigerator suitable for a common household will require a heating element of 400 watts and 300 liters of cooling water per 24 hours, having under normal conditions a cooling effect corresponding to 10 kilograms (22 pounds) of ice. A larger type designed for the tropics has a cooling effect equal to a consumption of 20 kilograms (44 pounds) of ice per 24 hours. Scientific and practical tests have been made by Norwegian experts and the results have fully answered expectations. A strongly financed company has been floated under the name of Amundsen Refrigerator Company to take care of the manufacturing of the apparatus and the further exploiting of the patents in foreign countries.

A New Non-Burnable Fumigant

MOTHS and beetles that prey upon clothing, carpets and furniture are to be attacked with a very effective new fumigant devised by R. T. Cotton and R. C. Roarke of the United States Department of Agriculture. These investigators have found that a mixture of three parts by volume of ethylene dichloride and one part of carbon tetrachloride is very effective against pests of this type. The mixture is cheap, non-flammable, non-explosive, non-injurious to stored commodities, and not dangerous to human life. The toxicity of the mixture is approximately five times that of carbon tetrachloride alone. In reporting their results in the *Journal of Economic Entomology*, these investigators say in part:

"Insects used in the experiments were chiefly: the clothes moth, *Tineola biselliella*; the furniture beetle, *Anthrenus vorax*; and the black carpet beetle, *Attagenus piceus*. In one case other insects were used. In these experiments 40 insects of each

(Continued on page 565)



Courtesy of the Chemical Construction Company

Even in a small unit, such as that shown above, occupying a floor space only three by six feet, ammonia can be oxidized economically to oxides of nitrogen used in sulfuric acid manufacture. This small plant has replaced a much larger one that used Chilean nitrate for the same purpose, and is saving money for its owner. In the photograph, the numbers indicate the following parts: 1, Air filter; 2, Blower; 3, Mixing cylinder (convertible to stripping tower for aqua ammonia); 4, Filter for mixture; 5, Preheater for mixture and ammonia; 6, Converter; 7, Pyrometer; 8, Flow-meters for ammonia and mixture; 9, Air control valve; 10, Ammonia control valve; 11, Ammonia storage pressure gage; 12, Pyrometer alarm

fibers. Her tulle bridal veil is a nitro-cellulose product. The orange blossoms are precipitated calcium carbonate coated with paraffin. Her stockings are of rayon. Her slippers are of rayon and metal threads, the metal a tin-copper alloy. Her beads are made of collodion with fish-scale essence as the iridescent material.

"Her prayer book has a celluloid back (made from collodion and camphor) and the paper and ink are both chemical products. Even the traditional garter, embodying 'something old, something borrowed, and something blue,' is made of rubber rendered adaptable by chemical treatment, covered with rayon and ornamented with rayon and metal roses. It is an interesting note in this connection that this entire costume cost less than 26 dollars.

"And as for the remainder of the bride's trousseau, she now has an unlimited number of synthetic textile fabrics from which to choose! Brocaded rayon velvets, rayon

Bureau of Chemistry and Soils, Los Angeles, tend to disprove Dr. Harvey's conclusions. These investigators have carefully studied the effect of ethylene on citrus fruits, dates, persimmons, bananas, tomatoes, pomegranates and avocados and find that while the color of the fruit is affected, none of the changes ordinarily connected with ripening are observed. The astringency of green persimmons is destroyed by exposure to ethylene in concentrations of one in 5000 of air, but no other changes in the edible portions of the fruits were found.

Synthetic Methanol

TWO new processes for the synthesis of methanol using by-product gases as raw materials have recently been put into operation in this country. The processes used are similar in some respects to those developed abroad, but new features make them particularly efficient.

Applied Science for the Amateur

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Material of Value to All Will Be Found Here

CONDUCTED BY A. P. PECK

Model Airplane Fittings

IN our November issue, we announced the publication of a series of articles on the construction of model airplanes, and also gave instructions for the construction of a glider. Before going on with the details of a plane in which a rubber-band is employed, it will be well for the amateur builder to learn something of the fundamentals of model airplane building. Therefore, we present the following paper, prepared by the Playground and Recreation Association of America. By studying this carefully, you will be ready to go on with the construction of a flying model when the plans are published. Do not forget our offer to publish pictures of your home-made models as often as space will permit. Send in your photographs—others want to see what you have accomplished. The Editor.

IN the construction of model aircraft, various fittings are necessary to join the parts of the models together and to operate the pieces of mechanism. These are constructed of pieces of wire, metal, et cetera, which are found in most boxes of odds and ends. In the construction of some models which differ from the usual standards, ingenuity can often be used in making up special fittings, often from articles originally designed for quite a different purpose. The following examples of fittings illustrated in the drawing are typical for all model construction and can be considered either as explicit directions or as general suggestions.

In the construction of scientific models having frames consisting of two sticks open like a "V" and joined at the apex, a fitting known as a "nose-hook" is used at the front, both for joining the sticks and holding the rubber bands which compose the motor. Two nose-hooks are shown, one of heavy and one of light construction. The first type is used where piano wire cannot be procured and it is necessary to use a larger wire in order to obtain the necessary strength. The second type is the kind generally used on the record-making models and is formed of small piano wire of about fifteen thousandths of an inch in diameter. These hooks are made with round-nose pliers. The best procedure is to use a two-inch length of wire in the ends of which hooks are formed, after which the wire is bent in the center to form the "V."

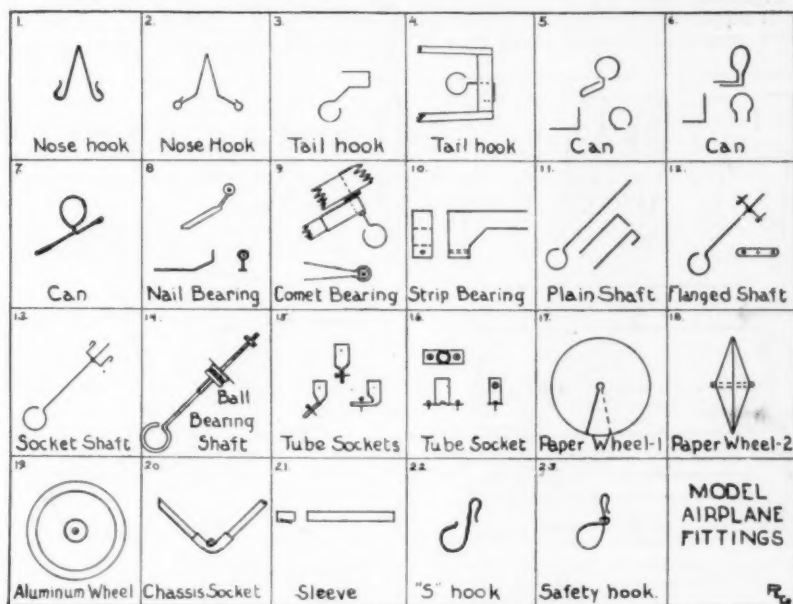
The next fitting shown is a "tail-hook" used on tractor models to fasten the rubbers at the rear of a single stick or frame. It is bent from light wire and the squared portion is made the same size as the stick and bound to it with thread. The next tail-hook shown is the kind used on scale models or tractor frames where the frame itself is used to support the rubbers. As illustrated, the wire is bent back into the tail piece in order to secure it.

The next three squares contain examples of "cans" or rubber guides. These are very

important and useful fittings on a model because they are fastened along the sides where the rubbers pass and distribute the strain of the rubber pull. They serve the same purpose on a model that agate eyes do on a fishing rod. They are called cans because, when these were first invented by model makers, they were usually made out of bamboo and were barrel or can shape.

or brass may be used, around a short length of tubing. The tubing is soldered in place. This type of bearing is used where the model has a rear brace to which the propellers are attached.

The third type of bearing shown in Figure 10 is made from strip metal, preferably a piece of aluminum about one sixty-fourth inch thick, one-fourth inch



Various types of model fittings described in these columns

The first square shows the kind most commonly employed. It is shown at the top in perspective, and at the bottom a side and end view of it are shown. It is noticed that the large loop of the can is left open. This is often a valuable feature when the model maker wishes to remove the rubbers from the cans while he is winding them, to prevent their abrasion. The next type of can is used on single-stick tractors where it is not necessary to draw the rubbers out of line during winding. The third type of can is the kind made when it is desired to use aluminum wire. The legs are somewhat flattened in order to make them more secure when they are bound on to the stick. This is shown in perspective.

Figure 8 shows a bearing which is used to support the rotating propeller shaft. It is the type most commonly used and can be easily constructed by beating and bending a small wire nail, after which a hole is drilled in the end intended for the shaft. The long part is bound to the motor frame. Figure 9 shows another type of propeller bearing, known as the comet type because the profile view of it resembles a comet. It is formed by bending a piece of strip metal, preferably phosphor-bronze, although tin

wide, and four inches long. It is bent to shape as shown in the front and side views and a hole for the shaft is drilled where indicated. In use, the two horizontal pieces are placed each side of the motor stick which extends to the front of the fitting and is bound in place. Some model makers prefer to secure this bearing with small nails or screws.

The propeller shaft is, of course, very important and four types are illustrated in the drawing. Figure 11 shows the plain shaft which is commonly used. In fact, it is the trend among all model makers to use fittings which are both simple and light. This plain shaft is made from piano wire on a similarly stiff wire about one hundredth of an inch in diameter. It is secured in the propeller by bending over the end as explained in the article on propellers. Some model makers prefer to bend the end back into the propeller, but with balsa propellers this is not advisable because of the weakness of the wood.

The next type of shaft shown is used where the model maker is of an experimental inclination and wishes to try different kinds of propellers, making their replacement by an easier method than

straightening the shaft, as is necessary with Figure 11. To construct this flanged shaft, a small flange is soldered to the shaft where shown. The propeller is secured by driving small nails or screws through the flange holes into the propeller hub. Figure 13 shows a type of shaft which is an improvement on the flanged shaft. In this type the flange is elongated and formed into a hook at each end, after which it is bent around the propeller hub. The propeller is secured to the shaft either by a piece of wire surrounding the hub and fastened to the two hooks or by a small rubber band between the two hooks. The type of rubber band that should be used is known commercially as an "election" band. They are about the diameter of a pencil lead. Incidentally, these bands are useful for another purpose which will be discussed under the subject of "S" hooks in a further paragraph.

Figure 14 shows a ball-bearing shaft such as is supplied by commercial model airplane companies for their better class of

next view shows another type of socket also made from copper tubing by sawing a slit in one end and bending out the two sides to form a base. The copper tubing, from which these sockets are made, may be purchased at most hardware stores, but in the event that it cannot be secured, use empty .22 caliber rifle shells.

Where models are intended to rise off the ground, a wheeled chassis is usually employed, although skids are sometimes used. A very serviceable wheel may be constructed from stiff paper. As shown in Figure 17, a disk is cut from this paper and a scissors cut is made from one edge to the center. The disk is then slightly cupped like the cone of a radio loudspeaker and the edges which overlap are cemented together. Then, as shown in the next view, two disks are placed together and their edges fastened with ambroid. Passepartout tape with serrated edges can be run around the rim to strengthen the wheel. A small length of copper tubing similar to that used for the comet bearing is ce-

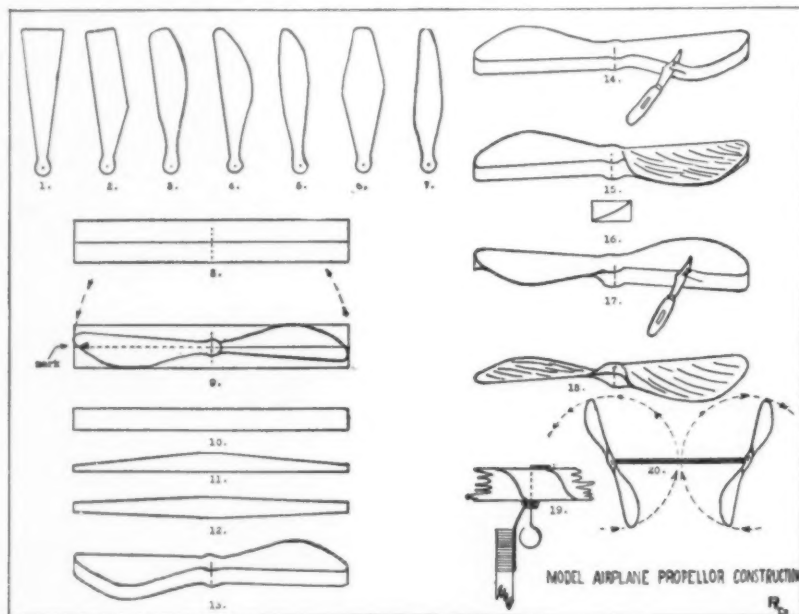
sleeves can be purchased from model supply houses also. They are used sometimes in scientific models to enable the model maker to separate his model for packing.

The last two spaces show "S" hooks. These are very useful fittings and are employed on both scientific and scale models where it is desired to unhook the rubber motors from the nose-hook in order that they may be wound up with a geared winder. The first type is intended to be constructed from coarse wire and the second is intended to be made from small piano wire. As will be observed, the second type has the end of the hook turned so that it will engage the shank. This prevents it from opening up under the strain of the rubber pull. On both of these "S" hooks, it will be advisable to use a short length of small rubber tubing to prevent the rubber motors from being cut. This rubber tubing can be obtained either from commercial rubber companies, model supply houses, or from the insulation on electric wires. Rubber bands of the "election" type are useful for fastening the rubber motors and the "S" hooks together. When this is done, the rubbers do not come off of the "S" hooks when the rubber motors are unwound.

It is hoped that the above directions will enable model makers to build their models properly. Every constructor should endeavor to make his model as light as possible and avoid the use of many metal fittings which, although they may add to the appearance of the model, will make it undesirably heavy and detract from its flying qualities.

Model Airplane Propellers

UPON the proper design and construction of the propeller depends much of the flying ability of an airplane. In the following paper, prepared by the Playground and Recreation Association of America, many valuable points are brought out. Watch for the publication of instructions on how to build a model plane. The propeller required for the first model to be described is ten inches long. From the article presented here, you can make the propeller, and thus be that far advanced when you get your next instructions. The Editor.



Steps in making propellers. See text at right

scale models. Some of the more mechanical model makers make these shafts themselves, but as their construction requires the use of a lathe, it will be necessary for most model makers who prefer them to purchase them. This type of shaft can be purchased for about 65 cents each. Their only fault is their weight.

In the construction of scale models and occasionally in scientific models, particularly where the scientific models have land or water chassis, sockets are used for receiving the ends of struts and cross pieces. These tube sockets can be easily made by taking a small piece of copper tubing and cutting it off to the length desired, after which one end is squeezed together, preferably in a vise. The squeezed portion can be either left straight or bent at an angle, depending upon the position where the socket is used. Sockets are fastened to the frame by screws or nails through the tongue, and the strut, which is held in the barrel of the socket, is retained by a small nail for which a hole is shown in each view. The

menting in the center to insure smooth running. On the more elaborate scale models, some model makers may prefer to use more ornate wheels. These can be purchased from model supply houses. A type of aluminum wheel having rubber tires and being very attractive can be purchased for 20 cents to \$1.25 each, depending on size.

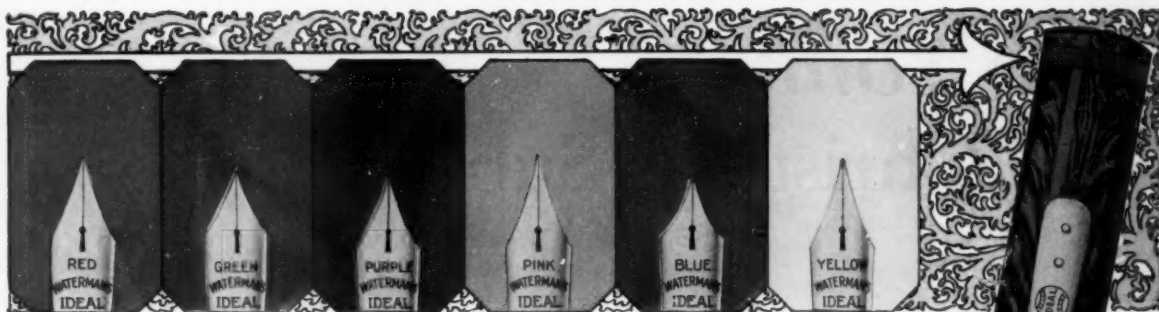
The fastening of the wheels to the chassis is often a problem with model makers. Figure 20 illustrates a possible method for accomplishing this by use of a piece of copper tubing pinched in the center and bent in a "V" shape to receive the chassis struts. The axle is fastened in the crotch of this fitting, using either wire, thread, or rubber bands.

In the construction of scale models, it may at times be desirable to make them so that the wings can be removed from the body. To do this, tube sockets are sometimes used and often a sleeve is employed. This sleeve can be made from thin aluminum sheet bent around the spar of the wing or other wooden member. These

PROPELLERS are often spoken of as air-screws, and that title explains their use. They are designed to screw their way through the air the same as a corkscrew, when turned, moves through the cork. Of course, air is less dense than a solid substance like a cork, and so an air propeller does not move forward with 100 percent efficiency. The difference between the distance that a propeller would advance in a solid substance and that which it actually advances in air is called the slip. Propellers should, of course, be designed to have minimum slip. Early aircraft propellers slipped as much as 60 percent, but modern propellers are much more efficient and slip only about 20 percent. Model airplane propellers can be made to be very efficient because the wood of the aircraft which they propel is quite light and therefore the propellers are not retarded very much. The model maker should take a tip from this fact and make his models as light as possible, in order that his propellers may exert the maximum push.

Referring to the drawing, it will be noticed that the first seven figures show pro-

(Continued on page 559)



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The Coach Ideal for Owner—Rider—Driver

THIS great era of motor travel has developed a vigorous need for a coach of medium capacity, of tested performance, providing the maximum in comfort, safety and attractiveness, moderate in price, and serviced "around the corner."

International Harvester provides such a coach in the versatile and popular Model 15. This 6-cylinder International finds and keeps a host of friends wherever its route runs. It answers many calls, establishing profitable routes of shuttle-like frequency, serving railway stations and hotels, serving as feeder to car lines, as peak-load auxiliary to organized routes

serving the suburb, country club, and subdivision, taking the rising generation to the schools—or what have you? It is a money-maker and community builder in one.

The International Model 15 was especially designed and is now fully perfected for this inevitable market. It fits the natural coach needs of every community. It is bound to appeal to any man interested in passenger transportation.

Furnished in three styles, the street-car type (shown above), the Club Coach, and the Sedan Coach. Equipped to carry 15 to 17 passengers—the ideal capacity. Write for the Model 15 Coach Catalog.

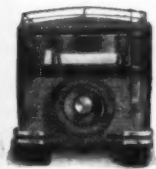
As for Service

To attend your coaches, there are 154 Harvester-owned branches all over the United States and Canada. In addition, International Trucks and Coaches have adequate representation in foreign countries throughout the world.

The International line also includes Speed Trucks and Heavy Duty Trucks, and McCormick-Deering Industrial Tractors

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SIX CYLINDER **HARVESTER** **COACHES** SIX CYLINDER
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International Model 15 is built on proved coach-engineering principles of design, throughout. The 6-cylinder engine has a large reserve of speed and power. Any chassis-unit or part of any unit may be removed without disturbing any other unit, and with minimum effort.



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Strays From the Ether

A Monthly Review of the Progress Made In All Branches of Radio Communication

CONDUCTED BY ORRIN E. DUNLAP, Jr.

Pooling Intelligence Stabilizes Industry

RAPID stabilization of the radio industry is due in no small part to the benefits derived from association of the leading makers of radio apparatus in an old-established electrical manufacturers' organization, where pooling of intelligence in engineers, in council and in human associations has been firmly established for more than a decade, according to Ray H. Manson, chief engineer of the Stromberg-Carlson Company.

"About five years ago," said Mr. Manson, "it was wisely decided by a few of the pioneer radio manufacturers to affiliate with an established and experienced manufacturers' organization, rather than to form its own group and waste effort in learning how to conduct association matters. At that time, radio was considered electrical in character, the same as it is now, so it was natural for the manufacturing group selected for its affiliation to be the organization then known as the Associated Manufacturers of Electrical Supplies and now broadened in scope and known as the National Electrical Manufacturers' Association—popularly designated as 'Nema.'"

"With the smooth running machinery of an experienced organization to handle its routine business, the attention of this newly formed radio group was focused on some of the more important problems of a new and rapidly growing business. For example, it was discovered that radio plugs of various makes would not fit radio jacks of other makes; that cord tips on head sets or loudspeaker cords would not enter the holes provided in radio plugs, or would not go into the openings in the binding posts of the radio receivers; that battery polarity on the jacks of the receiving sets did not always coincide with the polarity of the head sets or loudspeaker; that color-code

designation on cords and cables was not uniform, therefore misleading and confusing; that binding posts on batteries did not accommodate any one standard type of connecting cord terminal; that the 'B' batteries of various makes were of different shapes and sizes, so as not to fit into any definite cabinet space; and last but not least, that purchasers demand a large variety of equipment to meet special conditions, most of which could have been avoided by intelligent standardization."

New Amateur Record

FOURTEEN thousand miles covered with a low-power battery-operated short-wave transmitter is the record established by Clair Foster, a radio amateur at Carrol, California. He is now a member of the "Wac," an amateur group known as the "worked-all-continent club." In making the record Foster talked with an amateur in South Africa, using a 201-A receiving tube in his transmitter entirely operated from dry batteries. On the same day he communicated with Shanghai, China, completing the list of continents where his signals have been heard. All communication was done on the 32.2 meter wave, except with England, for which the 20.2 meter channel was employed.

When to Replace Tubes

A RADIO set owner writes: "There is one announcer on the air who in connection with a commercial program is attempting to sell tubes by calling attention to the fact that 'if one tube goes dead' all other tubes should be replaced for best results.' I am inclined to believe that he should be more specific. One tube may have been in the circuit a year and the others four or five months, or

one tube, namely, the detector, controlled by a separate rheostat, may be supplied with more current than the others and naturally it would wear out more rapidly. I can see that if all tubes were in the set for a year that probably better results would be obtained if all tubes were replaced, but he is absolutely wrong when he tries to advertise the fact that if one tube is worn out that the others should be replaced too. What is your opinion?"

You are quite right. If one tire on an automobile is worn out it is no indication that the other tires should be replaced if they continue to give good service. The one tire may have been in longer service, or seen more wear in its particular position and naturally it would blow out first. The same principle applies to vacuum tubes.

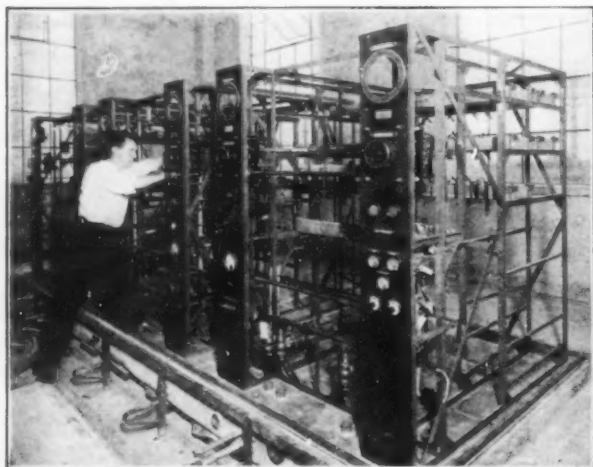
But do not forget that a new battery placed in the circuit with others on the decline will wear out much quicker than if all batteries are new. It is not economy to run a new battery with old ones.

Number of Standards for Radio Doubled

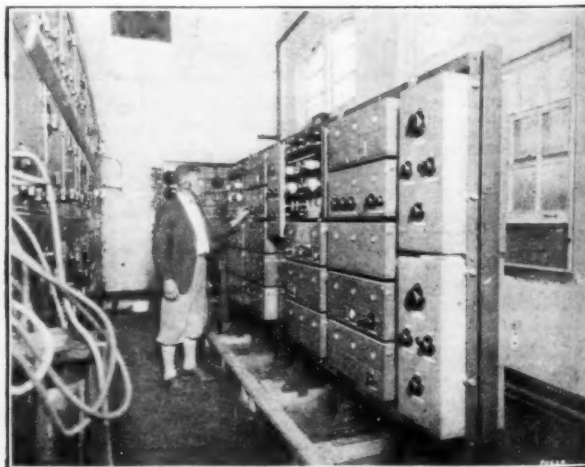
THE third edition of the *National Electrical Manufacturers' Association Radio Standards*, September, 1927, is now available. This issue has double the number of standards contained in the second edition of March. The new book contains about 400 standards as follows: 105 general standards, 81 covering transmitters, 100 receiver, 52 battery and socket power, 56 vacuum tube.

Appendices, occupying a total of 43 pages on radio symbols, revised underwriters' rules, Institute of Radio Engineers' preliminary standards and a complete cross index add to the value of the book.

To quicken progress in the radio industry,



Marconi short-wave beam transmitting apparatus being installed at Rocky Point, Long Island



The receiver for short-wave beam transmissions from England is located at Riverhead, Long Island

Silent Magic



Here is the Eveready Layerbilt "B" Battery No. 486, Eveready's longest-lasting provider of Battery Power.

TURN your radio dial, and presto! you turn your home into a theater, a concert hall, a lecture room, a cabaret, a church, or whatever you will. Turn the dial and your attentive ear does the rest. That is all there is to this magic of radio.

Or almost all. If a radio set is to work at its very best, attracting no attention to itself, creating for you the illusion that can be so convincing, you must pay a little attention to the kind of power you give it. There is but one direction, a simple one—use Battery Power. Only such power is steady, uniform, silent. It is called by scientists pure Direct Current. Any other kind of current in your




Radio is better with *Battery* Power

radio set may put a hum into the purest note of a flute, a scratch into the song of the greatest singer, a rattle into the voice of any orator.

Don't tamper with tone. Beware of interfering with illusion. Power that reveals its presence by its noise is like a magician's assistant who gives the trick away. Use batteries—use the Eveready Layerbilt "B" Battery No. 486, the remarkable battery whose exclusive, patented construction makes it last longest. It offers you the gift of convenience, a

gift that you will appreciate almost as much as you will cherish the perfection of reception that only Battery Power makes possible.

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Tuesday night is Eveready Hour
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WGR—Buffalo	WDAF—Kansas City
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WSAI—Cincinnati	WGY—Schenectady
WTAM—Cleveland	WHAS—Louisville
WWJ—Detroit	WSB—Atlanta
WGN—Chicago	WSM—Nashville

WMC—Memphis

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KFI—Los Angeles
KGW—Portland

EVEREADY
Radio Batteries
—they last longer

The air is full of things you shouldn't miss

various terms have been accurately defined by the standard-making body of the National Electrical Manufacturers' Association, among which is a definition of distortion, defined as "a change in wave form as in passing through a circuit or transmission medium. A wave form may be distorted by (a) the presence in the output of components having frequencies not present in the original wave due to circuit elements having non-linear characteristics; (b) a change in the relative amplitude of the component frequencies due to variation in transmission efficiency over the frequency range involved; (c) a change in the relative phase of the component frequencies. Two or more of these forms of distortion may exist simultaneously."

extremely short waves in communication with airplanes. It is believed that the planes could probably pick up the dispatches but if some one on the ground desired to eavesdrop he would have to go up on a hill or on top of a building with a receiving set.

New A-B Unit

A NEW receiver light socket unit, supplying both "A" and "B" power for the set, has been introduced by the Willard Storage Battery Company of Cleveland, Ohio. The device is supplied with a control switch that automatically controls the charging current as the set is turned on and off. A feature of the power unit is a new

the claims of the government that Alexander Meissner, a German inventor, discovered the feed-back (regenerative circuit) and audion (vacuum tube); those of the Westinghouse Electric and Manufacturing Company that Major E. H. Armstrong was the inventor, and the claims of the General Electric Company that these important radio discoveries were made by Irving Langmuir.

This controversy has been in course of litigation for several years. Dr. de Forest has won four decisions but it is probable that before the issue is finally settled it will be passed upon by the United States Supreme Court.

When Tubes Wear Out

A READER asks, "what takes place in a vacuum tube when it is being aged?" The majority of filaments are of the thoriated-tungsten type. As the tube is used, the thorium is consumed and gradually the thorium, which aids the electron flow, is used up. The tube is then said to be "worn out." In some cases the tubes can be rejuvenated by disconnecting the "B" batteries and burning the filaments slightly above normal brilliancy for about half an hour. There are also devices on the market called "tube reactivators," which operate on much the same principle as this.

WHBL on a Train

RADIO fans who tune-in and hear the waves of station WHBL are in touch with the Pioneer Limited of the Chicago, Milwaukee and St. Paul Railway as it moves along through the Wisconsin countryside at 70 miles an hour.

A steel baggage car is devoted to the radio installation. Sound-proofing the studio and transmitting rooms in the car is given special attention. Part of the transmitting room is enclosed with double sound-proof walls, double plate-glass windows and special doors. This excludes even the sound of the locomotive's whistle.

The 70-foot car is divided into four compartments. The first of these contains the power plant. The second compartment of the car has been converted into a transmitter room housing a 100-watt transmitter set using an inductively coupled Hartley circuit, Heising modulated.

The studio proper, the third compartment of the car, is directly under the observation of the operator through a glass partition. This compartment is treated in the same manner as the studios of the larger broadcasting stations, having the floor padded and carpeted, the walls heavily draped, the ceiling treated for sound, and lighted from the top both by windows and silver electrical fixtures.

The fourth compartment of the car is an entrance hall or ante-room opening out of the rear, providing access from the passenger cars of the train, for the housing of the accessories carried for the operation of the station and for the convenience of the operator and the studio director.

The antenna system consists of a caged antenna and caged counterpoise of equal dimensions carried on opposite sides of the car, the counterpoise being permanently located and the antenna cage being arranged for raising to a height of 60 feet, using a steel tubular mast when the car is not moving.

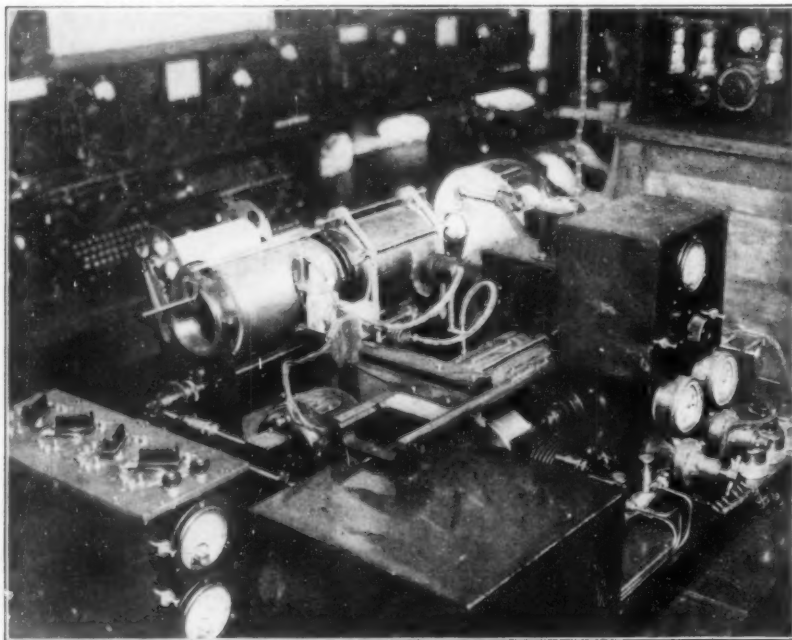


Photo-radio installation on board the U. S. S. Texas. The transmission system employed is that developed by Captain R. H. Ranger

The layman may find considerable amusement in the fact that the radio industry has recently adopted standards defining what the entire industry is all about—namely, broadcasting! Broadcasting is defined in the new standards adopted July, 1927, as "the transmission of music, news, entertainment or other intelligence intended for general reception."

Five-Meter Mysteries

THE five-meter experimental transmitter at station WGY looks like a bird house suspended about 60 feet in the air. The coop is about three feet square. A copper rod about ten feet long projects upward from the roof of the station to serve as the aerial. The signals cannot be heard on the ground but are clearly audible on hills or on top of high objects in the "line of vision." These short waves act the same as light waves. They seem to travel in a straight line. If a building or a hill intervenes, there is a distinct shadow or "dead spot" on the side opposite the transmitter.

The property of the waves, which enables them to carry messages to tops of hills leads engineers to foresee a possible use for

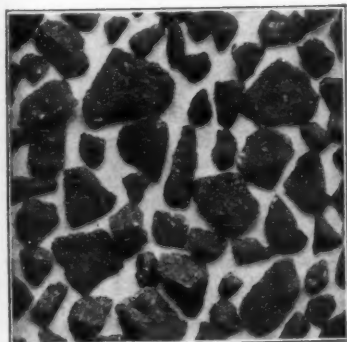
type electrolytic rectifier that increases the plate potential to 180 volts for the operation of the UX-171 power tubes, and at the same time supplies 40 milliamperes of current, which is said to be adequate for all general receiving conditions. A 135-volt terminal is provided for UX-112 power tube operation. The detector voltage may be varied from 15 to 50 and the amplifier voltage from 45 to 110 by means of adjustable knobs. A 67.5 and 90-volt terminal is also provided.

The "A" portion of the unit consists of a 40-ampere hour, 6-volt storage battery, provided with a charging device that may be regulated between one-half and two amperes. A set of gravity-indicating balls within the glass battery case show the condition of the charge at all times.

De Forest Wins

AN important victory in radio was won by Dr. Lee de Forest when the United States Circuit Court of Appeals at Philadelphia recently held that he is the inventor of the radio feed-back circuit and oscillating audion. The court, in a verdict by Judge Victor Woollen and concurred in by Judges Buffington and Davis, overruled

*A wet floor is
ordinarily a slippery floor*



That desirable combination—wear resisting and slip-proof effectiveness—are obtained by employing Norton Alundum Aggregates embedded in the finish coat of cement.

BUT a Norton Floor in any wet place is practically non-slip.

Take for example this milk station floor—non-slip wet or dry. It is a concrete floor with Alundum Aggregates embedded in the surface.

The permanency of "Norton Floors" and their proof against slipping hazards has been established by installations indoors and out.

NORTON COMPANY, Worcester, Mass.

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How many are 421,000 stockholders?

*An Advertisement of the
American Telephone and Telegraph Company*



ON OCTOBER 15th, American Telephone and Telegraph Company checks representing the 152d dividend were mailed to its 421,000 stockholders. That is the largest number of stockholders of any company in the world. The American Telephone and Telegraph Company is owned by a great investment democracy. Its dividend checks are cashed at banks in every state in the Union, by people representing all trades, stations and professions.

No institution is more nationally or publicly owned than the American Telephone and Telegraph Company, which in turn owns more than 91% of the common stock of the operating companies of the Bell national System. The average holding is 26 shares, and no one person owns as much as 1% of the total stock.

The Bell System was developed in the interest of telephone users and is owned by the public that it serves.

The Scientific American Digest (Continued from page 538)

glass for cooking vessels. In the manufacture of this glass a considerable quantity of boric acid is used, and it is indirectly this which confers relative unbreakability to the material.

The reason common glass breaks easily when suddenly heated or cooled is its comparatively high co-efficient of expansion. When cold water or cold air is suddenly directed against hot glass, the outer layers contract first, and if they contract very much before the change of temperature can be transmitted to the inner layers, differential stresses are set up which may cause the glass to break. One way to obviate this difficulty would be to use quartz, which contracts or expands only about one eighteenth as much as glass under a given fall of temperature. But quartz melts only at extremely high temperature; to manufacture it is expensive. Therefore boric acid is added to quartz sand. This acts as a flux, lowering the melting point very markedly, yet producing a glass which has many of the qualities of fused quartz. For these reasons the Pyrex variety of glass is called "borosilicate"—borax plus silica (quartz is one form of silica). While Pyrex is best known to most of us because it is widely used in the kitchen, it is also used in most modern chemical laboratories in place of the more breakable chemical glassware employed until recent years.

The new supply of borax whose discovery is announced below was found in California about 100 miles, as the crow flies, northeast of Los Angeles. To quote from the *Daily Science News Bulletin of Science Service*:

"The discovery of some eight million tons of an entirely new mineral all in one huge deposit in Kern County, California, has set a record in modern mineralogy. The mineral is "rasorite," named after its discoverer, C. M. Rasor, leading borax engineer of the Mohave desert field. While new minerals in small quantities turn up once in a while in various parts of the world, it is unusual for so vast a quantity of an entirely new natural chemical substance, and a valuable ore at that, to be so long overlooked.

"Rasorite is known to chemists as the tetrahydrate of borax. As freshly mined, it emerges in striated crystalline bars of glassy texture, some as large as common stovewood. It requires only a recrystallization with an added quantity of water to yield commercial borax, whereas all other important borax ores such as colemanite and ulexite require expensive chemical processes with resulting high prices of the product."

"According to chemical theory, the natural rasorite is a substance which cannot be produced under the ordinary atmospheric pressure of 15 pounds to the square inch, and thus had never been observed either in formations on the surface of the earth or in the synthetic laboratory. Great pressure, due to an over-layer of lime borate and desert sediment, has permitted the formation of the unique compound far below the surface of the Mohave desert. The deposit is located almost on the Kern-San Bern-

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ardino county line a few miles northwest of Kramer, California, and thus near the transcontinental line of the Santa Fe to San Francisco. The supply in sight is enough to meet the needs of the United States for over 50 years at the present rate of consumption.

"The market price of borax, already sagging from keen competition among California and Nevada corporations, seems to be headed decidedly downward as the new branch railway line to the rasorite mines nears completion. Borax is used extensively in enamels, welding fluxes, laundry materials, et cetera, but its application in the almost unbreakable borosilicate glass promises the most conspicuous new benefits. At present a few bottles, pitchers, baking dishes and other vessels of this glass are marketed at high prices, but if borax, the critical ingredient, should go below 40 dollars a ton there will likely be a much wider use of the new glass. Borosilicate glass, composed largely of sand and borax, expands but slightly on heating and thus will stand boiling water and even oven temperatures without cracking.

"As now constituted, fruit jars and milk bottles offer a fertile field for improvement. Unfortunately, the manufacturers of bottles will have to be shown why they should make an unbreakable bottle and thus have no opportunity to sell replacement. The dairyman passes on the responsibility for cracked glassware to his deliveryman and customers, and so he has not yet become excited about the matter. However, the casualty list on bottles is enormous, taken the country over. Somebody has to pay the bill, and if the consumers' demand for stronger bottles becomes insistent enough they will doubtless be made."

Scientific Research Underlies Prosperity

A MILK bottle, a display of feminine hosiery and the picture section of a newspaper occupied places of honor on the platform of the New York Electrical Society, when Dr. Harrison E. Howe, editor of the American Chemical Society's journal, *Industrial and Engineering Chemistry*, spoke on "Will Prosperity Continue?"

The present unparalleled prosperity of the United States is based largely, Dr. Howe said, upon the intensive application of the results of scientific research which has been so prominent a feature of recent industrial progress. This was the significance of the milk bottle, the silk stockings, and other articles with which Dr. Howe shared the platform. Time was, Dr. Howe said, when no one except kings or millionaires could possess even a goblet made of glass, let alone anything so perfect as a modern milk bottle. Glass was once suitable only for second-rate, but very expensive, strings of beads for feminine adornment. Now it forms the transparent panes of our windows and a hundred everyday household utilities like milk bottles. The change is due, Dr. Howe pointed out, to the gradual accumulation of hard-won scientific facts by hundreds of the world's scientific investigators.

The present importance of paper in the world Dr. Howe illustrated by the size and cheapness of a modern news-



The Builder

The power that placed the monster stones of the Pyramids is still open for debate; but who questions that wire rope is the great Builder of today?

Much of the wire rope used in construction is Yellow Strand, that famous brand with one strand of yellow. Made in St. Louis and Seattle by a pioneer in the wire rope manufacture, the supreme quality of this king of ropes is recognized throughout the Western Hemisphere and in many countries across the "great waters."

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paper. Scientific research has been responsible, also, for converting paper from another of the expensive perquisites of kings and wealthy temples into an everyday convenience for the common man. The legs of our ladies constitute still other living pictures of scientific progress, as Dr. Howe illustrated with stockings made of one of the newly-developed materials which are more than substitutes for silk, because there are some ways in which they actually are better than silk. These new synthetic fibers which science has presented to the world have the advantage of being transparent to the health-giving rays of ultraviolet light, so that stockings made of them admit these essential rays to the living skin beneath.

A piece of colored cloth displayed by Dr. Howe cost, he said, only a few cents. Yet this cloth was dyed with a color even brighter and more beautiful than the famous purple of Tyre, a dye which emissaries of ancient emperors extracted, drop by drop, from a shellfish living in the Mediterranean Sea. Nowadays, thanks to scientific research, even better purple dyes are within the reach of everyone.

One entirely new industry, the aluminum industry, has been created, Dr. Howe said, as the result of modern scientific research. An ordinary aluminum saucepan was an exhibit, he pointed out, of crystallized and concentrated science, for without scientific research, aluminum would be still a laboratory curiosity, not at all the useful metal which it is now.

Dr. Howe cited figures assembled by the National Research Council, indicating that more than 90 percent of the total income of present-day Americans may be traced to the earnings of processes, industries or products which are based upon the results of scientific research.

The "children of research" are as numerous and diverse in modern America as are our industries themselves. Together with the milk bottle, the newspaper and others, Dr. Howe exhibited samples of the new "duco" varnishes for automobile use, of the synthetic leather called "fabricoid," of the new sugar named "cerulose," of solid carbon dioxide or "super-ice," of the chemically hardened edible fat called "crisco," of the new "electro-rubber," and others.

The continuation of American prosperity will be largely affected, Dr. Howe predicted, by our success or failure in supporting further research work in America and in utilizing its results.

Diet to Make Cure for Hookworm Safe

RESEARCH to make the potent drug that has cured millions of cases of hookworm absolutely foolproof was reported to the American Physiological Society at its recent Rochester, New York, meeting, by Dr. Ann Minot of the Vanderbilt University School of Medicine.

"During the last few years," said Dr. Minot, "carbon tetrachloride has been used more extensively than any other drug in combating hookworm disease, which is widespread in practically all the tropical countries of the world. This drug combines the advantage of being cheap with extraordinary effectiveness

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and a very high degree of safety. Among the several million cases treated, there have been very few deaths which seem to be caused by the drug used. These fatalities were very puzzling because they occurred only at rare intervals in widely different localities. Much work has been done in an attempt to explain why a drug which may be used with perfect safety in several million cases is capable of suddenly proving fatal in an occasional instance."

Research undertaken by Dr. Minot, however, showed that dogs fed on a well-balanced diet containing plenty of calcium would tolerate large amounts of the drug without harm. But when the amount of calcium was reduced, even small doses of the drug would have an injurious effect which could be cleared up by restoring the calcium.

These results, the woman scientist explained, seem to justify the belief that further cases of carbon-tetrachloride poisoning can be prevented in people by providing the hookworm patients who have not been eating sufficient calcium with liberal amounts of food containing this necessary element before the course of curative treatment is begun.

—Science Service.

Handsome Apples Rank Last in Taste

POSITIVE proof that beauty is only skin deep, at least in the realm of apples, was recently demonstrated by an experiment conducted by Roger B. Corbett of Rhode Island State College.

In his test Mr. Corbett took four varieties of apples, peeled them, and cut them into cubes which he placed before eleven different men, ranging from bankers and professional men to farmers and mechanics.

The apple that was rated first when seen whole, shining in its brilliant red skin, ranked last in taste. In the taste test the McIntosh won first place, the Baldwin second, the Rhode Island Greening third and the Rome Beauty last. The Rome Beauty, a dessert apple that is a favorite in stores and on fruit stands, when peeled was found least tasty.—Science Service.

Radio No Fertilizer, Experiments Indicate

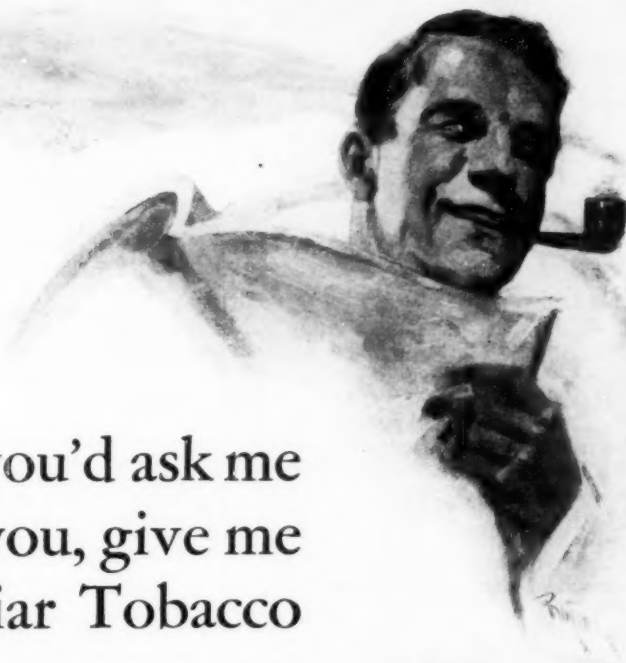
RADIO waves will never make two blades of barley grow where one grew before, declare plant physiologists of the United States Department of Agriculture, in reply to statements ascribed in a recent news item to Admiral W. H. G. Bullard, chairman of the Federal Radio Commission. Admiral Bullard was quoted as saying that barley planted under the radio towers at Arlington grew so high that it overtopped men walking through it, due to the influence of the radio waves.

Many researches have been conducted in electiculture to determine this very point, the scientists state, and the results have always been either inconclusive or distinctly negative. The Arlington barley, it is pointed out, had no "control." That is, there was no other plot of barley planted on exactly similar soil but removed from the possible influence of the waves. Without such "controls" no biological experiment has any value whatever. In the experiments of the plant physiologists there were always "control" plants, which showed little or no difference from the ones exposed to the electrical waves.—Science Service.

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IN THE EDITOR'S MAIL



"Franklin Rods"

MANY of our readers will be interested to know that there is at last a museum where historical exhibits of science and invention can be preserved for all time. The first actual exhibit is referred to in this letter.

Editor, SCIENTIFIC AMERICAN:

Perhaps many of your readers would be interested in knowing that a section of the iron lightning rod which Benjamin Franklin placed on St. Paul's Cathedral, London, England, somewhere about 1770, is now in New York in the Museums of the Peaceful Arts in the SCIENTIFIC AMERICAN Building.

The first lightning conductor ever constructed was set up by Franklin on his house in Philadelphia in the summer of 1752. The use of lightning conductors spread very slowly in the United States, but in 1764 St. Bride's Church in London was severely damaged by lightning. This aroused the authorities so that steps were taken to protect St. Paul's in London and "Franklin rods" were attached to Wren's splendid structure.

About 1770, Benjamin Franklin was called in to advise as to this matter. A ring of iron was fixed around the lantern inside and forced tappings were taken downward from this and passed through openings in the wall, and they were connected with the dome. The cross was connected with the existing metal work by means of a rod of iron. The specimen which is shown in the photograph was taken from a position between the ball supporting the cross and the lead dome. The system of conductors is now very complete and Franklin's iron rods have been displaced by a complete system of copper tape taken from the ball

at four different points and carried down at four different points to the earth without any breaks. The authenticity of the specimen now in New York is attested by the Clerk of the Work of St. Paul's.

Yours very truly,

A. H. A.

New York City.

Help!

IF any of our readers have any information on the subject mentioned in the letter below, we would suggest that they communicate with Mr. Laird.

Editor, SCIENTIFIC AMERICAN:

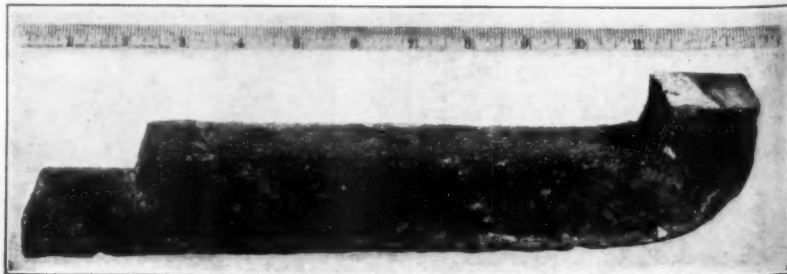
Your readers could undoubtedly be of help to this laboratory in studies we are making of methods of cutting down noise in offices and shops.

We would appreciate it if you would suggest to your readers that they write us about any methods they have found useful in silencing machines without decreasing their output, or methods of preventing reverberation of sounds once started in a room.

Donald A. Laird, Director
Psychological Laboratory,
Colgate University,
Hamilton, New York.

This Month's Amateur's Telescope

OUR telescope-making campaign refuses to die, which is just what we like. Instead, it spreads and gains ground. The number who have taken up this work since the publication in March, 1926, of the SCIENTIFIC AMERICAN instruction book "Amateur Telescope Making," is now well along past 2500, and the interest keeps up at a uniform, steady rate. We expect this "short-lived fad," as it was once dubbed by a doubting Thomas, to outlive



A section of Franklin's original lightning rod

all our editorial staff—and we are not so very antique at that. Here is an interesting letter from a locomotive engineer on the Union Pacific Railroad. He says he thoroughly enjoys making telescopes. So do we.

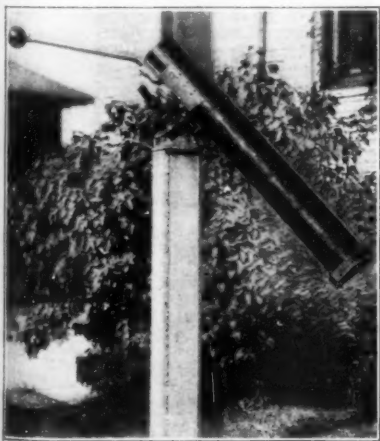
Telescope Editor,
SCIENTIFIC AMERICAN:

With the "bug" inoculated by the book, "Amateur Telescope Making," I have com-



Mr. Bergstrom's first telescope was small but he found it useful. It is better to start with a modest instrument than to fail with a large one, as a few have done

pleted two reflecting telescopes. The first is small, having a three and one-fourth-inch mirror, the mounting being identical to the one described in Figure 27 of your book, except that a tube was substituted for the long wooden supporting bar. A double lens of one-half-inch focal length—a watch maker's glass—was used for the eyepiece. The instrument gives a wonderfully clear and beautiful view of the moon.



Experience gained on his first telescope enabled Mr. Bergstrom to do his best work on the second one. And now he is at work on a third, and the end is not yet!

My second telescope has a six-inch mirror, parabolized and slightly undercorrected. The mounting is made up of two Ford front wheel assemblies secured at the



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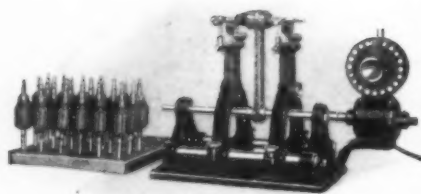
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This special process is the final step in the manufacture of Dumore motor armatures. Preceding it, careful selection of materials, extra insulation, accurate turning of under-cut commutators, all contribute to increased life and serviceability.

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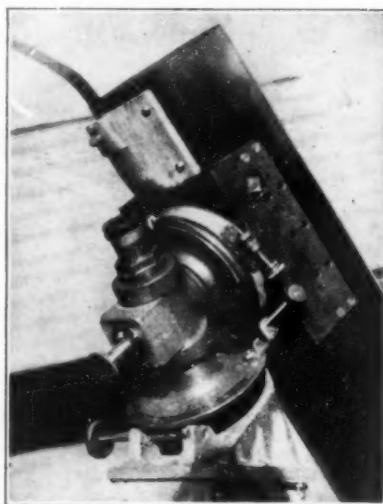
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**Dynamically Balanced
Universal Motors**

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48 Sixteenth St., Racine, Wis.

auto wreckers. This is well shown in the photograph, and I will try to describe it by mail to amateurs who may wish to duplicate it. The declination axis is made up of a one and one half by three-inch pipe nipple, threaded from end to end. A Timkin roller bearing, also secured from an auto wrecker, is employed.

The telescope stand was made up of three quarter inch angle iron and light



A close-up of the two home-made axes of the telescope, made almost entirely of parts recovered from an auto-wreckers junk pile

galvanized sheet metal fastened together with stove bolts. It is thoroughly braced and is very light and rigid.

I think I have found a hobby in telescope making that will stay with me for life. Since beginning this interesting work, my leisure time has not included one dull moment. Every step, beginning with the setting of the handle on the mirror with pitch, until the last touch was completed, was exceedingly interesting. It is a real recreation. At present I have an eight-inch disk on the polishing tool.

I really feel that I owe to you the pleasure I have had with this new hobby. It sure "takes the cake" for keeping up an unabating interest.

H. O. Bergstrom.

P. O. Box 491, North Platte, Nebraska.

The Sport of Model Making

CURIOUS indeed is the psychology which brings recrudescence of various phases of science. Like the child who plays again with some toy that has been put away for a time, with an eagerness as for an entirely new amusement, so we often see the return of interest among the grown-ups for something that has long been considered passé.

Model making as an entertainment flourished prominently some years ago; then practically died out. The last three or four years has witnessed a very decided revival of interest, for besides numerous books published on the subject, we find working models of ships of all kinds; complete locomotives and trains—both abroad and in this country; working models now on exhibition in the west, of an entire line of road building machinery; models of electric-lighting layouts, safety signal systems, etc cetera.

It may therefore be of considerable interest to call attention to the illustration which we show of a working model of a locomotive built a number of years ago by C. C. Helmick of Akron, Ohio, from plans published in the SCIENTIFIC AMERICAN. Recently the Assistant Secretary of the Akron Association of Model Engineers, J. W. Neptune, discovered this model in the builder's attic and with his permission rejuvenated and placed it on exhibition.

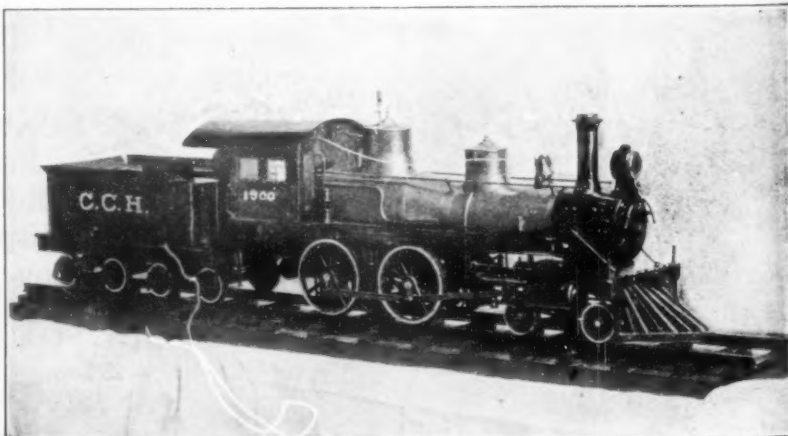
Length, 41 inches; drivers, five inches; height, 10½ inches; air-brakes on all wheels; weight, 60 pounds; steam pressure, 125 pounds; gage, four inches; uses coal; cylinders, one inch by one and five eighths inches; M. C. B. auto-couplers.

Has the Keeness of Eyesight of Birds Been Exaggerated?

FROM one of our readers. Mr. Frederick Law Olmsted of Olmsted Brothers, the well-known Brookline, Massachusetts, landscape architects, we have received the following inquiry:

Editor, SCIENTIFIC AMERICAN:

The very interesting article by Dr. Eltingham in the SCIENTIFIC AMERICAN for last December on "The Multiple Eyes of Insects" suggests to me the possibility of another article that would be extremely interesting (if you can get the right man to do it) on



This model of the locomotive that pulled the funeral train of President McKinley was built from plans published years ago in this magazine

an allied subject which has caused a good deal of (generally very loose) theorizing: namely, a comparison of the quality of vision of good human eyes with that of certain birds (notably hawks, eagles, and buzzards) as well as with that of insects.

Frederick Law Olmsted.

Although we suspected that the suggestion would prove fruitless, for we believe science has not yet fully investigated the subject of eyesight in birds, we referred Mr. Olmsted's letter to Dr. Alexander Wetmore, Assistant Secretary of the Smithsonian Institution and President of the American Ornithologist's Union. Dr. Wetmore's interesting reply follows:

Editor, SCIENTIFIC AMERICAN:

Vision in birds is remarkable to me for its accommodation that permits, for example, a sparrow to distinguish a seed within an inch of the end of its bill, and at the same time allows it to distinguish a hawk soaring high overhead. Most birds have a distinct faculty for two kinds of vision. One, monocular in which both eyes work independently, and the other binocular in which both concentrate on the same object. There are in most species two distinct centers of sharp vision for these two types of sight.

Much is current in literature regarding the keenness of sight evidenced in vultures where, according to the popular concept, the smallest fragment of food is seen by birds so high in the air as to be practically invisible to humans. During approximately 30 years of observation throughout the New World, from this country south to Patagonia, I confess that I have never seen anything of the kind. It is my candid opinion that vultures soar aloft merely for the pleasure of a joy ride in the ether, and when they are actually hunting for food they are sweeping in great circles near the earth in loops that bring them down within a few yards of any object that seems to promise food. Through this incessant quartering, they distinguish easily, snakes, mice, or dead creatures of any kind and descend to feed. Larger creatures, of course, can be seen from a much greater distance, but I do not place the slightest credence in their seeing small bodies at any great distance.

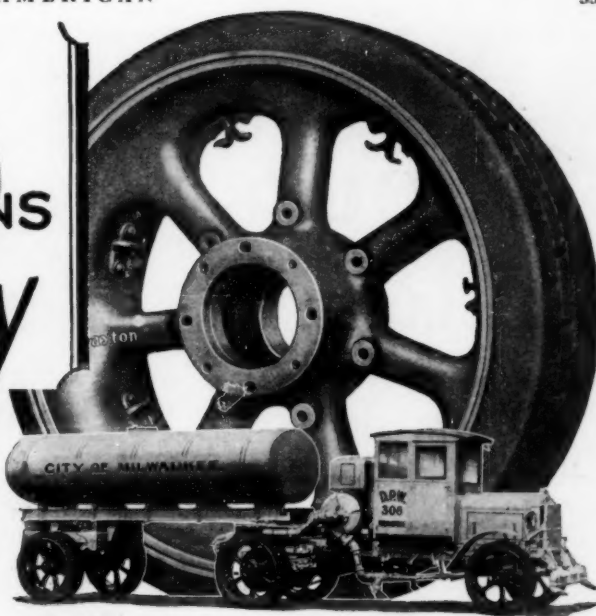
It has been my common experience when stopping to rest or to examine some bird or other creature that I had shot for a museum specimen, to have, within a few moments, a turkey vulture or even a condor come sweeping overhead looking down curiously to see what I was about. Unquestionably such birds have come to learn that man is an animal to be kept under observation, and that when he stops he is liable to leave behind him something that may serve for food. I have even had the yellow-headed vulture, in the South American Chaco, fly in to alight above me in a heavy forest in which I had momentarily disappeared from view.

Many vultures are gregarious to a point where they assemble nightly in central roosts from which they spread out to search for food. In their quartering back and forth they are frequently in sight of one another so that when one descends to feed others are soon tracking to it, particularly to carcasses of considerable size. I do not see in this, however, any indication of the wonderful eyesight usually ascribed to them, but rather merely an example of their careful search for sustenance.

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(Continued from page 544)

propeller blades of various patterns. Number 1 is the style used by two early aircraft pioneers, namely, Maxim of England, and Langley of America. This form is easy to make because the rough blank can be sawed out with a straight saw, and the carving itself is simple. Many model makers choose to make their propellers of this blade shape, and when the propeller is carved out, they round off the corners and make a shape resembling that to the right. Other model makers prefer to cut out the desired blade shape in the blank form.

Figure 2 shows the type of blade used by the Wright brothers in their historic airplane, which was the first to carry a man into the air. It is more efficient than the Langley; in fact the Wright propeller may be described as a Langley propeller with one of the corners cut off.

Figure 3 is a blade pattern used a great deal. A study of this form will reveal that it is merely an adaptation of the Wright shape with the corners rounded off. A modification of 3 results in type 4. This shape is very popular with model fliers because it is easy to carve and performs well in the air. Blade 5 is a further modification of 4, and is the shape often used by the United States Navy on their seaplanes. It is quite efficient. Figure 6 shows a type of blade commonly known as the diamond pattern. It is more difficult to carve than the shapes to the left, but the resulting propeller is pleasing in appearance and performance. Figure 7 shows the shape of blade used on the latest metal propellers which have been establishing world's records for performance.

The method of producing an aircraft propeller is as follows: Propellers may be made of any light wood, such as pine or spruce, but for the racing models balsa wood is preferable because of its lightness and the fact that it can be easily worked. A piece of wood is obtained which will be large enough to accommodate the propeller desired. It may be stated that the smallest models require a propeller of not less than five inches diameter and on the largest models it is customary to use propellers of about 12 inches diameter.

The drawing was made of a typical propeller of the shape shown in Figure 4, and the width is based upon a 10-inch propeller. For longer propellers the blade should be narrower and for shorter propellers it should be a trifle wider. In this typical propeller the width of the blade is seven eighths of an inch, and the thickness is five eighths of an inch. This would do for a 36-inch model intended for general flying. If the model is intended for long flights, the pitch of the propeller blades should be increased, which is accomplished by using a thicker blank.

Figure 8 shows a piece of wood intended for the propeller. The model maker draws upon stiff cardboard a propeller blade outline having the distance from the center to the tip one-half of the intended diameter. The center of the propeller blank is marked and a line drawn down the length of the block, as shown in Figure 8. The center of the propeller outline is then placed above the center of the block and pivoted with a pin. Then, as shown in Figure 9, the shape of the propeller outline is drawn on one-half of the block and a mark made on the outline where the outline touches the line on the block. The outline is then swung



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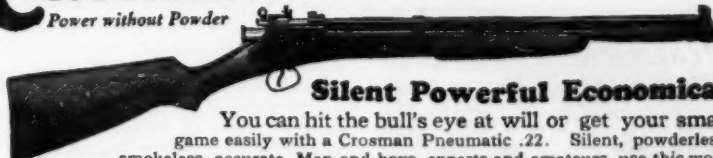
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around to the opposite end of the block and the mark on the outline and on the block placed together. By drawing around the outline in this second position the shape of the propeller is completed. It is very necessary, when laying out the propeller, to get the two blades diametrically opposite.

The next step is to drill a hole through the center of the propeller. This should be done carefully, making sure that the hole is perpendicular to the surface. In the case of a pine propeller, a drill carefully adjusted should be used, but with balsa propellers the wood is so soft that an ordinary pin pushed through will make a sufficient hole. The ideal tool for cutting out propeller blanks is a band-saw, but as these are only obtainable in established wood-cutting shops, the model maker who has only ordinary home equipment may have to use a hand-saw of the keyhole or coping variety.

Having cut out the plan view of the propeller, we are next concerned with the profile. This may be left rectangular, as shown in Figure 10, or the blades may be tapered either toward the base or from the center, as shown in Figures 11 and 12. Tapering the blade usually imparts to the model greater speed, but if the model is intended for duration it would perhaps be best to leave the propeller rectangular. The cut out blank is shown in Figure 13.

A right-handed propeller with a curved entering edge will be made from this blank. Considerable discussion has occurred in the past on the question of whether the entering edge of a propeller should be curved or flat. Most authorities prefer the curved edge and this preference may be substantiated by the fact that in aircraft, rounded edges produce the best results. On the latest racing planes there are no square edges. Even the connections between the wings and the body are rounded off. As a practical way of deciding the question of round edges versus straight edges, a model maker recently made comparative flights, using in one instance propellers having straight entering edges, and for another flight he used propellers with round entering edges. The round edges achieved the best results.

To carve the propeller, begin cutting as shown in Figure 14, and cut away the wood on the face of the blade leaving the straight edge high and cutting the round edge down to the bottom, producing the result shown in Figure 15. The blade should be slightly cupped, as shown in the end view of the propeller at Figure 16. Turning the propeller around, the opposite blade is carved in the same way and then a small needle is inserted in the shaft hole. Using this as an axle, the propeller is balanced. Should one blade be heavier than the other, additional material must be cut until the balance is perfect. After this, the blades should be sandpapered smooth.

The opposite side of the propeller is cut as shown in Figure 17. This second side should be carefully carved to make sure that no deep cuts are taken which cut through the blade, and yet the blade should be made very thin. The progress in cutting can be watched by frequently holding the propeller before an electric light and noticing by the "pinkness" of the wood how thin the blade is becoming. This thinness should extend to the tips of the blades, which should be about one sixteenth of an inch thick. The thickness of the blade should increase toward the hub, but the outer two thirds of the blade should be uni-

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formly thin. When the backs have been carved, the propeller should be again balanced and sandpapered; then the hub should be cut away in order to reduce its weight. The propellers of record-making models have hubs as thin as an eighth of an inch, but for a model maker's first efforts he should have a thicker hub in order to avoid the possibility of breakage.

As above stated, the foregoing description applies to a right-handed propeller. A left-handed propeller is made by making the cuts in an opposite manner. A right-hand and a left-hand propeller are shown in Figure 20.

Figure 19 shows how the propeller is fastened to the frame of the model by means of the bearing and shaft, with its washers. As shown, the shaft is passed through the bearing and washers and into the hole. On the outside it is bent at right angles and if the propeller be made of pine it is indented and lashed to the hub. If the propeller be made of balsa, it will be sufficient to cement this bent-over section in its proper place.

The type of propeller described may be used on either a tractor or a pusher model. If used on a tractor, the model maker must so place it that it will pull the model forward. If on a pusher, it must push the air away from the model. Figure 20 shows the most efficient method of placing propellers on a twin-pusher model. It is assumed that the propellers have curved entering edges and that the model is being viewed from the rear. The propellers should turn upward and outward to get the best results. It should be mentioned that in case twin propellers are used on a model, they should weigh the same and should have the same inclination; in fact, they should be identical in push, balance, shape and weight.

As the model maker progresses, he will find out that propellers are a very important part of his model. He will learn that different models require different propellers, and that a propeller which may produce records on one model will not produce equal results on another. Inversely speaking, a model which will not fly with one propeller may fly with another type, so it behooves each constructor to study and experiment in order to obtain the utmost efficiency.

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(Continued from page 540)

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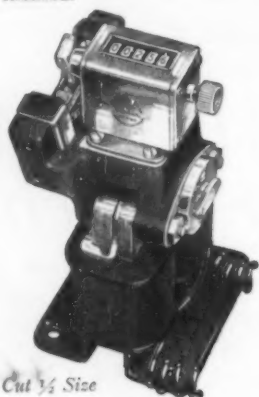
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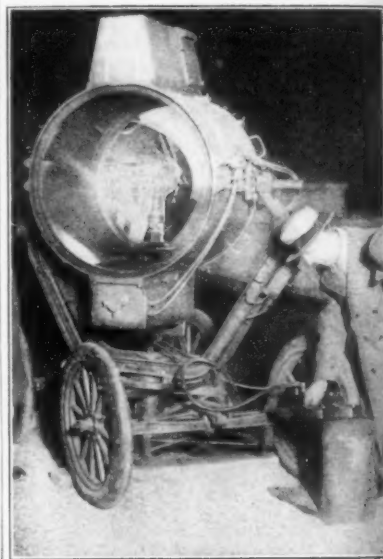
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house type, are elevated about 10 feet above the ground and are housed in small sheds on appropriate sides of the fields. Incandescent lamps, such as the Mazda lamp, have also been used as a light source with this lens. While the incandescent lamp is simpler and more economical to operate, its larger light source produces a greater vertical divergence than the intense, but concentrated arc.

The Sperry Gyroscope Company, and the Westinghouse Lamp Company, working in conjunction, have now produced an incandescent-lamp landing-light which bids fair to challenge the arc, and which has undergone highly successful tests at Mitchel Field, Long Island.

The immense bulbs employed consume 10,000 watts or over 13 horsepower. Large incandescent lamps have hitherto had a relatively short life, whereas the new lamps can be burned for several hundred hours. They are not subject to any troubles in starting or operating and work equally well on direct or al-



Wide World

The lamp illustrated on page 563 is used in this housing. It is used at the Ford airpost at Detroit

ternating current. To concentrate a great length of filament into a small space, a crimped ribbon of tungsten metal has been employed.

The light is provided with a 36-inch, parabolic silvered-glass reflector, and an 80-degree spread lens front door which disperses the reflected beam into a horizontal fan of light having a vertical divergence of only about four degrees. It conforms excellently to the requirement that the light shall spread only 10 feet above the ground. All stray light which might go upwards and interfere with the vision of the incoming pilot is eliminated by a system of semi-circular louvers which are an integral part of the unit.

Flight tests showed that a field could be illuminated for a distance of 3000 feet. The 36-inch drum has to be ventilated with a motor-driven fan.

There is no doubt that the new light will be of distinct utility in commercial aviation.

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Industries From Atoms

(Continued from page 542)

species were placed in cotton-stoppered, glass vials, and rolled up in rugs, or buried in the stuffing of upholstered furniture. The fumigant was applied by pouring it into a shallow pan near the ceiling of the vault.

"The results indicate that six pounds per 1000 cubic feet of space of the three-to-one mixture of ethylene dichloride and carbon tetrachloride is 100 percent lethal when used in a gas-tight vault, with a temperature of 85 degrees Fahrenheit and a 24-hour exposure. The same dosage at 65 degrees Fahrenheit, however, does not give a perfect kill. A dosage of 12 pounds of the mixture per 1000 cubic feet is 100 percent lethal at temperatures above 65 degrees Fahrenheit. For general fumigation work in gas-tight chambers it is recommended that a dosage of five quarts, or 14 pounds of the mixture per 1000 cubic feet be used. In comparison with carbon tetrachloride, the mixture appears to be about five times as toxic at ordinary temperatures.

"All experiments with this mixture indicate that the fumigant has excellent powers of penetration. Insects rolled up in thick rugs and buried in overstuffed furniture are readily killed. In a special test, flour beetles, *Tribolium confusum*, and rice weevils, *Sitophilus oryza*, were sealed up in cartons of cereal: specimens of the Indian meal moth, *Plodia interpunctella*, and the saw-tooth grain beetle *Oryzaephilus surinamensis* were buried in boxes of candy and other insects were buried in piles of clothing and rugs. A dosage of 14 pounds of the mixture per 1000 cubic feet at 80 degrees Fahrenheit gave a perfect kill."

Electroplated Chromium

METALLIC chromium can be deposited in a thin film by recently developed methods of electrolysis. The electroplate so produced has many properties which make it valuable to industry. In discussing these in a recent issue of *Industrial and Engineering Chemistry*, the writer said:

"The properties of chromium which make it particularly useful to industry are its extreme hardness and resistance to abrasion and its ability to withstand many of the ordinary agents of corrosion, including oxygen at high temperatures and superheated steam. Not only does the metal itself possess these properties to a remarkable degree, but a comparatively thin electroplate of it on an unresistant base metal imparts these properties to the combination to a useful extent.

"The hardness of chromium on Moh's mineralogical scale is stated as 9, which places it in the class of emery and far above any other known metal. This figure is not necessarily absolute, as the result of a test depends largely on the method of determination used, but the fact remains that chromium is harder than iridium and the hardest of steels. In electroplating it, some variations in hardness are possible according to the conditions of plating, but it is easily possible to realize its full hardness in a plate. One hears of tests made on very thin plates of chromium, over a soft base metal, which can be broken by a file, but a sufficiently strong base supporting a reasonably thick film will show a hardness greater than many gem stones,

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"Related to its hardness, but not necessarily inherent in it, is chromium's resistance to wear and abrasion. Even very thin films exhibit this property to a remarkable degree and metal parts subjected to the destructive forces of sliding wear can have their lives increased many fold by protection with a chromium plate. Such parts as bearings in automotive engines, engravers' plates, and fine gages have had their useful lives prolonged as much as four to eight times by chromium films less than a mil in thickness.

"Chromium is unaffected by the ordinary atmospheric agents of corrosion and retains a brilliant finish although exposed to rain, snow, and sea water. It resists all ordinary acids except hydrochloric and sulfuric, and is unaffected by sulfur compounds generally, including hydrogen sulfide, sulfur dioxide, and those present in petroleum and rubber dough. Molten zinc, tin and brass, ammonia, and the industrial organic acids, except oxalic, do not affect chromium. Its resistance to lactic and acetic acids is valuable. It is not discolored by heating in air up to 300 degrees, Centigrade, and resists physical breakdown oxidation up to 1149 degrees, Centigrade. Its melting point is 1520 degrees, Centigrade.

"Early chromium plates were unsatisfactory in their resistance to corrosion, possibly because of the difficulty of making a firmly adherent plate free from pinholes, a condition obviated by recent improvements in methods of its application. The presence of pinholes is especially to be avoided in a plate on iron as chromium is 'nobler' than iron and its presence tends to increase the speed of electrolytic corrosion of iron with which it is in contact. In general, it is preferred for corrosion resistance to put the chromium on top of a nickel or copper plate to insure protection of the iron and complete adherence of the final protective coating."

Pulp Mill Waste in Tanning

LEATHER prepared by using the waste of sulfite paper mills to replace customary tanning materials has been shown by the Bureau of Standards to be quite as satisfactory as that tanned by the ordinary procedure. The results of an investigation show that this waste material can be satisfactorily used for tanning when blended with other materials such as quebracho wood and chestnut-wood extracts. Thus two old industries may benefit by this use of a disagreeable waste.

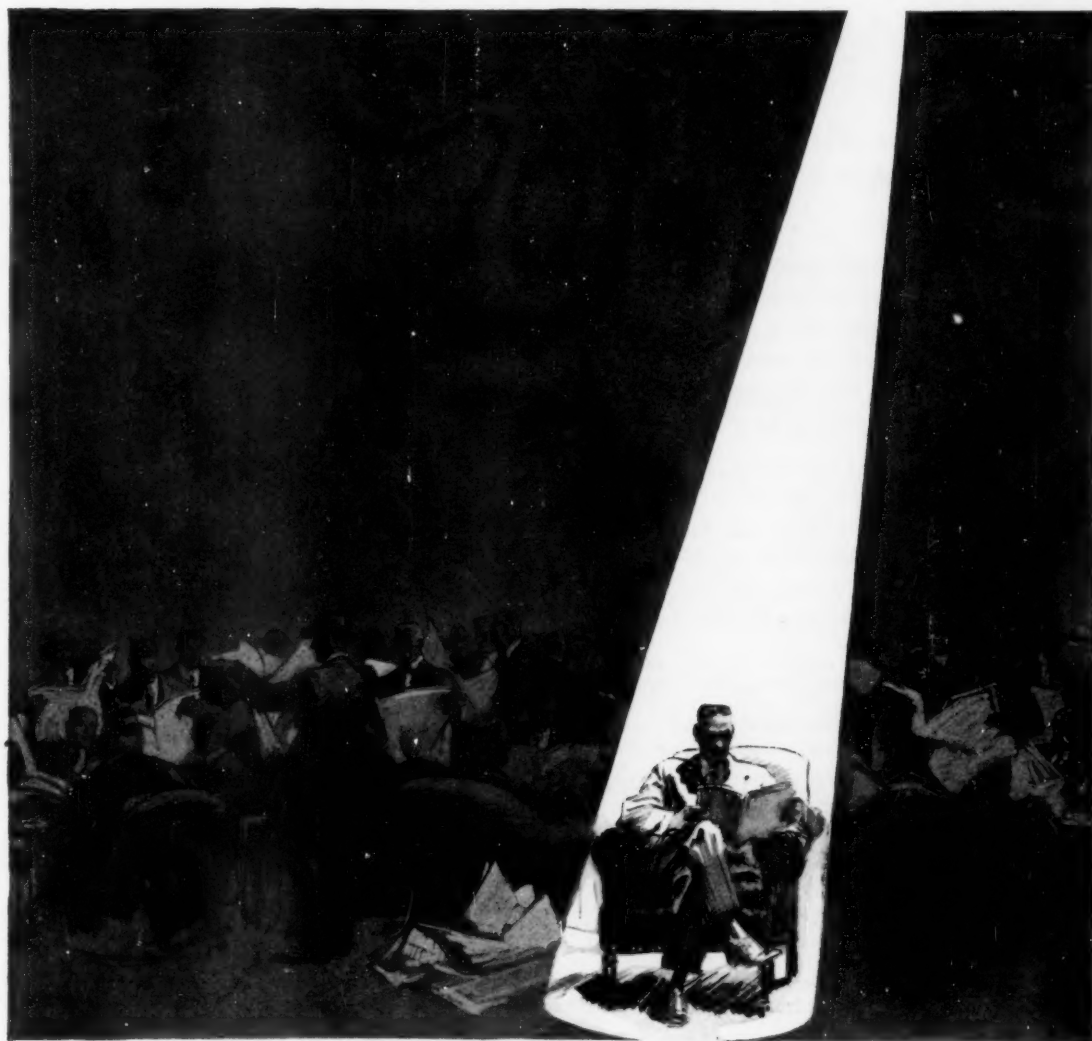
Carbon Dioxide, A Disinfectant

THE carbonation of beverages and water has a decided effect in reducing the bacterial content, according to Charles E. McKelvey, research fellow of the American Bottlers of Carbonated Beverages. Mr. McKelvey has conducted an extensive research on the bactericidal action of carbon dioxide at Iowa State College and reports the following conclusions:

"Carbon dioxide has a distinct germicidal effect upon bacteria, the magnitude increasing with the pressure of the gas.

"The effect upon different bacteria varies greatly, the pathogenic forms being killed most easily, and the spore formers resisting most.

"Despite its evident effect as a germicide, the use of carbon dioxide should be preceded by all possible sanitary precautions."



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Commercial Property News

A Department of Facts and Notes of Interest to Patentees and Owners of Trademark Rights

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Injunction After Patent Expires

A MANUFACTURER gets an injunction against a competitor restraining him from making, using or selling articles which infringe on the patent. Soon thereafter the patent expires, leaving the infringer with a large stock of infringing articles on his hands. There no longer being any patent monopoly, is he free to sell them?

Such was the question put to the Circuit Court of Appeals in the application for an injunction brought by the Fulton Company against Bishop and Babcock Company on a patent Fulton obtained on a thin, flexible metal bellows made from a thin-walled metal tube. An injunction, granted six months before the patent expired, had prevented infringements while the patent was in force, and the application now was to further restrain the infringers from selling articles manufactured in the lifetime of the patent.

The precise point does not seem to have been decided in this country heretofore, and the court drew its precedent from England, quoting Lord Chancellor Lyndhurst, as follows:

"I am of the opinion that the court would interfere, after a patent had expired, to restrain the sale of articles manufactured previous to its expiration in infringement of a patent right, and that a party would not be allowed to prepare for the expiration of a patent by illegally manufacturing articles, and immediately after its expiration to deluge the markets with the products of his piracy, thus reaping the reward of his improbus labor in making it.

"The court would, I say, in such a case restrain him from selling them, even after the expiration of the patent."

Reasoning from this, the court granted the injunction, saying:

"No violation of the patent law comes merely from selling the article after the patent expires; the violation is indirect; the basic reason of the result is that the article itself came into existence in violation of law.

"Its conception and birth were tainted. To permit it to be sold would be to impair the patent grant by shortening its term."

Notes and Beams in Trademark Oppositions

OFTEN, when the registration of a trademark is opposed by another trademark owner, the question will hinge on the validity not of the applicant's trademark, but on the validity of the opposer's trademark. Such was the case recently when the Rubber and Celluloid Products Company, owner of the trademark "Rubberset" for brushes, sought

to prevent the Star Brush Manufacturing Company from registering "Rub-R-Tite." In allowing the registration First Assistant Patent Commissioner William A. Kinnan says:

"It is believed plain enough the notation 'Rubberset' is merely descriptive. Anyone at all familiar with these goods and with the constructions of glue or cement-set brushes and with rubber-set brushes would understand the opposer's notation meant that the bristles of the brush were set in rubber. Such a person might not understand the process by which the product was obtained but if, on purchasing a brush so labeled, he found the bristles were set in glue or cement, instead of rubber, he would believe he had been deceived. There seems no other conclusion can be sustained than that the notation is merely descriptive.

"It would also seem proper to hold that even if the notation of the opposer company were sustained as a suggestive trademark, the rights under such mark could not be held so broad as to preclude others from using the word 'rubber' in connection with goods of the character

here under consideration. If it is correctly held that the term 'rubber' is public property, then the applicant company has not used it in a manner deceptively similar to the use which the opposer company has made of it."

Do Not Sleep on Your Rights

IF you hold a patent and sit idly by for years and make no protest while others build up a profitable business upon an infringement of your patent, you will not be permitted to recover from the infringers in the courts.

Such is the principle followed by Judge Runyon in the New Jersey Federal District Court in dismissing the suit for infringement brought by the Playograph Company against the Star Ball Player Company. Explaining why he finds the plaintiff guilty of laches, or inexcusable delay, the Judge says:

"The litigation here involved concerns the movable ball feature of the bulletin boards employed to depict in a graphic manner the progress of a baseball game and to show its movements play by play.

Patents Recently Issued

Classified Advertising

Advertisements in this section listed under proper classifications, rate 25c per word each insertion; minimum number of words per insertion 24, maximum 60. Payments must accompany each insertion.

Official copies of any patents listed in this section at 15c each; state patent number to insure receipt of desired patent copy.

Pertaining to Apparel

ATTACHMENT FOR SWEATERS AND THE LIKE—Which can be readily applied to sweaters and similarly knitted garments, to maintain their normal form so as to prevent stretching, and subsequent distortion. Patent 1639928. S. H. Cohen, c/o "Jerry-J." Co., 360 So. Los Angeles St., Los Angeles, Calif.

SHOWER SHAWL—A paper shawl, or cape and hood, adapted to be thrown over the head and shoulders in an emergency to protect the clothes from injury by rain. Patent 1641039. H. La Beaud, 208 W. 122nd St., New York, N. Y.

METHOD OF VARYING THE SIZE OF GARMENTS.—To make a garment or coat larger or smaller, as required to fit the person for whom it is intended, and to be of further use. Patent 1642627. M. Paley, 66 Spring St., Monticello, N. Y.

Chemical Processes

TIMBER PRESERVATION—For preventing decay of posts buried in the ground, by placing in contact with the buried part pulverulent arsenic-containing material of gradual solubility and continuous impregnation. Patent 1639601. H. C. Gardiner, Anaconda, Mont.

PAINT FORMULA—Manufactured from ground scrap rubber a solvent such as rosin, and linseed oil, dissolved by boiling, the product is substantially transparent and forms an undercoat. Patent 1639599. L. Francis, c/o Walsh, Beckman & Ellis, 701 Olympia Bldg, Miami, Fla.

Designs

DESIGN FOR A REFLECTOR—Patent 73251. A. de Lugo and J. W. Robertson, c/o Robertson Metal Arts Co., 157 E. 32 St., New York, N. Y.

DESIGN FOR A BOTTLE OR SIMILAR CONTAINER—Patent 73267. J. I. Poses, c/o Weil, Courson & Manges, 285 Madison Ave., New York, N. Y.

DESIGN FOR A LIGHTING-FIXTURE CANOPY—Patent 73390. M. Schlepp, c/o Sterling Spinning & Stamping Co., 476 Broome St., New York, N. Y.

DESIGN FOR A BADGE.—Patent 73403. M. I. Gerson, c/o Jack Sherman, Union Taxi Owners Association, 1441 Broadway, New York, N. Y.

Electrical Devices

HOLD-UP ALARM—A foot-operated circuit controlling means by which a merchant when held up may signal for help without the knowl-

"On July 23, 1913, The Baseball Playograph Company, a Connecticut corporation, filed its bill of complaint in this court against the Star Ball Player Company, defendant herein, alleging infringement of the first three patents above noted. An answer was filed and thereafter, for almost six years the suit dragged its way, being successively either dropped from, continued on, or restored to the calendar until, on June 1, 1920, an order was filed dismissing the cause under Rule 57.

"The last of the four patents, known as the Baker patent Number 1171830, application for which was filed November 25, 1912, was issued on February 15, 1916.

"The bill of complaint in the present action was filed June 25, 1923.

"In my opinion, the charges of laches is warranted. In the first place, the existence of the defendant company, as well as that of any of its allegedly infringing devices, was known to Baker, president of the Baseball Playograph Company and inventor of the fourth patent, when the original suit was started, and yet neither that company nor any of its successor assignees did anything decisive for the establishment and settlement of its alleged rights for almost nine years after the original suit was started and for more than seven years after the fourth patent was issued.

"In the meantime, and during all of the intervening period, the defendant company has busied itself openly and with each succeeding baseball season in the exploitation of its product, and the gaining of a market for it.

"It appears to me unjust, therefore, that after so long a period of inactivity, during all of which the various holders of the patent in suit were chargeable with knowledge, the plaintiff should now be allowed to press its suit in an endeavor to nullify the defendant's toil of years. Had the original plaintiff proceeded with its suit in due course, or had a suit been commenced within a reasonable time after the issuance of the fourth patent, the issues might have been long since settled, and both parties left with certain knowledge of their rights and limitations."

Patent Progress in Japan

AN internationally known firm of patent attorneys has just issued a report on the progress of the Japanese patent system in the reign of the late Emperor. The figures are interesting. In 1912 there were 7168 patent applications and 1774 patents. In 1926 there were 12,495 patent applications and 3520 patents. Apparently it was a little easier to get a patent in Japan 15 years ago than it is today. This is evidenced by the decreasing size of the percentage between the applications and issued patents.

In 1912 the mechanical patents numbered 1337 or 75.4 percent of the total, the chemical patents 284 or 16.6 percent, and the electric patents 153 or 8.6 percent. In 1926 there were 2566 mechanical patents or 50.4 percent of the whole; 1409 chemical patents or 27.7 percent; 1113 electric patents or 21.9 percent.

Commenting on the figures the report states:

"It must be noted from the above that the number of inventions of mechanic industries shows no tendency of marked increase, but gradually diminished in

edge of the bandit. Patent 1639578. S. Steinhart, c/o A. Steinhart & Bros., 1372 Broadway, New York, N. Y.

VARIABLE CONDENSER—In which one of the conducting elements has rolling contact with the di-electric element, effecting a variance in contact, whereby injury to the di-electric is eliminated. Patent 1637646. H. Kimura, 1604 West Jefferson St., Los Angeles, Calif.

DIAPHRAGM FOR TELEPHONIC APPARATUS—For sound sending and receiving, formed of thin discs with registering grooves, and a layer of viscous material interposed, whereby the diaphragm is without vibration. Patent 1640330. G. Lakhovsky, c/o C. Chassevent, 11 Boulevard de Magenta, Paris, France.

MAGNETO—Characterized by its breaking device, comprising two platinized nonadjustable contacts and a cam capable of determining their separation, and adjustable from the exterior. Patent 1640290. J. E. and S. E. Perisset, c/o C. Chassevent, 11 Boulevard de Magenta, Paris, France.

HAND LANTERN—An electric torch or flashlight so constructed that when the user requires both hands the lantern may be securely placed upon a supporting surface. Patent 1641880. G. Cohen, 201 W. 49th St., New York, N. Y.

LEAD-IN CONNECTION—Adapted to be applied to the wall of a room whereby a receiving set may be readily connected or disconnected with the ground and antenna wires. Patent 1642618. E. N. Naupin, Fallon, Nevada.

ELECTRICAL BINDING TERMINAL—To which a multiplicity of wires may be connected at the same time, and in which electrical contact between each, and the terminal, will be uniform. Patent 1642042. J. L. Polk, 3 Lake Place, Troy, N. Y.

Of Interest to Farmers

HITCH FOR DRAFT ANIMALS—Which affords facilities for connecting the harness of draft animals, one in front of the other, so that both may pull in a substantially straight line. Patent 1639608. C. Hoffland, Westhope, N. D.

MEANS FOR STERILIZING COTTON AND OTHER SEEDS—Which affords facilities for subjecting seeds to the action of live steam, whereby the extermination of insects and germs will be effected without injury to the seeds. Patent 1641097. P. H. Rylander, 209 E. 13th St., Austin, Texas.

Of General Interest

FLEXIBLE WASTE-PIPE CLEANER—Formed of wire coil and having a head mounted to effectively clean a pipe, and prevent kinking, when forced therethrough. Patent 1638766. F. E. Gros-vold, 319 So. Farwell St., Eue Claire, Wis.

HANDLE FOR HAND BAGS AND THE LIKE—Consisting of two straps attached at their outer ends, their inner ends joined by a sliding connection, thereby forming an extended handle or lying closely along the bag. Patent 1639574. D. I. Reiter, 100 Fifth Ave., New York, N. Y.

COMBINED HAIR COMB AND CUTTER—An attachment applicable to any shears and capable of use to enable one to cut one's own hair as in bobbing the same. Patent 1639617. E. Seavey, 359 Pearl St., New York, N. Y.

MARKER BLOCK—For use by carpenters, particularly to be employed in marking off spaces on the edges of doors to be mortised for the reception of hinges. Patent 1629053. C. C. Schrader, Hughson, Calif.

PORCH SWING—Which affords facilities for making use of motion which results from the operation of the swing to oscillate a fan above the seat. Patent 1640274. 2011 So. 44 St., St. Petersburg, Fla.

STANDING BOARD—A yielding mounted platform or more or less oscillatory floor board.

percentage. On the contrary, inventions of chemical and electric industries have steadily increased both in number and percentage. Particularly noteworthy is the fact that the number of inventions of chemical industries show an increase during 1915-1918, while mechanic and electric industries diminished. The increase, it is considered, is an outcome of an extraordinary progress of Japan's chemical industries during the World War. As for the invention of electric industries, the number shows an abrupt increase since 1921 and the percentage is only 8.6 in 1912, but 21.9 in 1925, the rate of increase being 115.5 percent. This phenomenon indicates the remarkable development of the electric industries in Japan in recent years."

Dilatory Tactics Are Dangerous

SOMETIMES an inventor will keep a patent application pending as long as possible. In such a policy there are certain obvious advantages. Among them may be mentioned the fact that the patent's 17 years of life do not begin to run out until the patent issues. The writer knows of one application which was kept pending 34 years.

That such a policy is dangerous, however, is well illustrated by the recent decision of Assistant Commissioner Kinnan affirming the rejection of appealed claims in the patent of Rutherford Sutherland Smart for an electric heater.

"This case presents an unusual and unjustifiable record," says the Assistant Commissioner. "The construction involved is exceedingly simple and yet the application has been pending nearly nine and one-half years. The reference relied upon was cited in the first action in the case, over nine years ago, and for the last seven years the case has been pending before the examiner, no new references were cited.

"Eight times the examiner has reviewed the claims for this simple construction. He should have closed the prosecution of the case before him years ago. The great amount of work presented to this office precludes such numerous reconsiderations in a case of this character.

"The applicant has no basis for complaint that the examiner finally closed the prosecution of the case before him when he did. The applicant certainly has been given an opportunity to present any and all claims that he reasonably could have desired to have reviewed."

Sales Enterprise

SOME publication ought to run as a regular feature, true-life examples of how wide-awake business men recognize and seize opportunities to increase business. For example:

In the City of Florence, Italy, where the streets are narrow, parking of motor cars has been prohibited. Recently, however, certain public squares were designated as parking places.

One morning at the principal square of the city where about 20 cars can park, it was discovered all the available space was occupied by a complete series of a certain moderately priced American automobile. No salesman was in evidence, but crowds surrounded the fleet of cars all day long—there being no time limit—admiring the cars. Sales of this make of car have been more than satisfactory since then.

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for persons who are compelled to stand or walk on a confined area. Patent 1640326. C. V. Jonasson and H. J. Boal, c/o Nultnomah Hotel, 4904 29th Ave., Portland, Ore.

SEAT WITH FOLDING BACK—Comprising a seat and back respectively hinged to the upper end of folding legs, and connected with iron fittings ensuring rigidity, and compact folding. Patent 1640273. J. A. Halais, c/o C. Chassevent, 11 Boulevard de Magenta, Paris, France.

NAUTICAL INSTRUMENT—Whereby the latitude position of a ship, or an object on land, may be easily determined by a simpler method than the ones usually employed. Patent 1640328. G. Koffskey, 730 Clouet St., New Orleans, La.

CONSTRUCTION OF REINFORCED CONCRETE FLOORS—Comprising a number of narrow ribs extending across the spaces between solid concrete slabs positioned over the supporting columns, and crossing at right angles. Patent 1641084. W. R. D. Innes, and M. S. Stanley, c/o Messrs. Collison & Co., 483 Collins St., Melbourne, Australia.

CLOTHES-HANGING APPARATUS—Conveniently mounted in the wall of a room, so that clothes may be passed through the opening without necessitating a person leaving the house. Patent 1641106. J. Van Duzer, Firthcliffe, N. Y.

RAT GUARD—Which can be releasably, yet firmly, secured to ship cables of various sizes, without it being necessary to thread the cable through the guard. Patent 1641081. N. Heymann, 2041 Magazine St., New Orleans, La.

WINDOW PORTAL—Which may be inserted in an opening formed in glass or other material, and requires no screws or other securing means to firmly maintain it. Patent 1641044. P. J. Murphy, 1131 Teuton Ave., Bronx, N. Y.

COWL—In which an outlet tube is provided with an opening in its rear face maintained by the action of the wind, and insuring easy movement. Patent 1641060. H. C. Wehrfritz, 204 Claremont Ave., Jersey City, N. J.

SPRAYER—Adapted for use with various types of liquid varnishes, lacquers, enamels and the like, upon surfaces such as motor vehicle bodies and parts. Patent 1641023. R. J. Coffey, 101 Halsey St., Brooklyn, N. Y.

KITCHEN-TUB COVER AND DRAINER—Wherein the upper lid is used as a closure, and the lower depressed foraminous member is used as a drainer for dishes or other articles. Patent 1641061. H. Young, 301 E. 72 St., New York, N. Y.

STEAMING BRUSH—For brushing cloth in tailoring establishments, whereby the steaming and brushing operations are done at one time, steam being projected through the brush. Patent 1641037. I. Kirschenbaum, 223 George St., New Brunswick, N. J.

BRIEF CASE—Of leather, so reinforced with spring wire, that it will resist permanent distorting strains and will automatically go back into proper shape after twisting or warping. Patent 1641871. S. Solomon, 35 E. 21st St., New York, N. Y.

GUARD FOR POISON BOTTLES—Which may be easily adapted to various bottles, and will prevent the careless or hasty removal of corks or stoppers of bottles containing poisons. Patent 1641897. W. Moses, 1477 E. 92nd St., Cleveland, Ohio.

SHINGLE—Having locking means integrally formed for cooperating with the complementary portions of overlapping shingles, rigidly securing the projecting free ends against movement. Patent 1641858. J. A. McCarthy, 1325 Buchanan Ave., St. Joseph, Mo.

PHOTOGRAPHIC FILM OR PLATE PACK—Provided with a protecting sheet and a pulling strip, the protecting sheet being the same length and width as the plate, and the pulling strip twice as long. Patent 1641867. M. and J. Romanowicz, c/o Paget, Moeller & Hardy, Riemergasse 6, Vienna 1, Austria.

NAPKIN HOLDER—Providing a simple means for dispensing napkins and other paper articles in single succession, as in restaurants and other eating places. Patent 1641841. J. M. Fernandez, 231 E. 95th St., New York, N. Y.

LAMP EXTINGUISHER—A device for manually extinguishing the flame of a kerosene lamp, also capable of automatic operation, when for example the lamp accidentally falls. Patent 1641254. C. D. Dunbar, Buckeye, Texas.

SHIP'S LOG—Wherein the power transmitting cable is connected by a single lever with the actuating piston and an accurate reading is secured at different speeds. Patent 1641907. R. Star, 84 Flushing Ave., Brooklyn, N. Y.

DISPLAY BOX—Comprising two hinged connected sections of unequal cross sectional dimensions, one of which may be disposed for display when the sections are in open relation. Patent 1641861. S. Moss, c/o Star Case Co., 380 2nd Ave., New York, N. Y.

POCKET OUTFIT FOR THE CARE OF TEETH—The outfit comprises a tooth brush disposed in a hollow handle, which also houses a suitable dentifrice, all being protected by a cap assuring aseptic conditions. Patent 1642620. J. R. Merrill, c/o Office Picard, 97 Rue St. Lazare, Paris, France.

COMPACT HOLDER AND EJECTOR FOR VANITY CASES—Wherein the compact is held in place against accidental removal, but in position to be easily swung loose and quickly ejected. Patent 1642611. W. G. Kendall, 118 Market St., Newark, N. J.

MATCH BOX—Arranged as an article for securing together the ends of a belt for supporting in a convenient position a supply of matches, or other small articles. Patent 1642629. J. Rankin, Louisa, Ky.

BAG RACK—Which is of simple and durable construction, which has the capacity to handle paper bags of various sizes, and in any convenient arrangement. Patent 1642619. J. Medlock, Grandfield, Okla.

ALL-METAL TELESCOPIC BOX FOR CAMERAS—More particularly for copying cameras, comprising box-like sections telescopically associated, easily operated for carrying out focusing operations, and will be very durable. Patent 1642651. A. H. Gaebel, c/o Gaebel Corp., 225 Broadway, New York, N. Y.

RE-ENFORCED MINE PROP—Possessing increased strength over the usual wooden props of equal cross sectional area, being constructed with a metal casing and a central hard-wood core. Patent 1642603. M. J. Conway, 99 South 11th St., Coalesville, Pa.

Hardware and Tools

CORE BARREL—A sampling or coring device designed to contain and securely hold, while the tool is being withdrawn, a sample of the formation in well drilling. Patent 1640264. O. M. Carter, Scanlan Bldg., Houston, Texas.

DRILLING TOOL—Whereby samples of the formation may be frequently taken so that the possibility of unconsciously drilling through a producing strata is reduced to a minimum. Patent 1641113. P. Brunt, 42 Grant Road, Addescombe, Croydon, England.

CLEANING IMPLEMENT—A tool so constructed for supporting a mop head that it may be readily manipulated to grip or release the mop head or bundle of rags. Patent 1641034. M. E. Harber, 344 High St., Richmond, Ky.

Heating and Lighting

HEATING AND VENTILATING DEVICE—In the form of a grille supported adjacent a window and against the wall for directing heated air upwardly and outwardly into a room. Patent 1640331. S. R. Lewis, c/o Am. Foundry & Furnace Co., Bloomington, Ill.

STOVE—For burning oil, wherein heat is efficiently generated with economy in the consumption of fuel, convenient control, and safety in the operation of the burners. Patent 1641064. H. M. Britan, Ojus, Fla.

GAS BURNER—Which thoroughly comingles the gas or other fuel and the air, to produce a highly combustible mixture adapted to generate a maximum amount of heat and little or no deposit of carbon, the burner has reversible jets producing either a laterally or upwardly directed flame. The inventor has been granted two patents 1641274 and 1641275. P. C. Hughes, c/o Hughes Plumbing Co., Tulsa, Okla.

AUTOMATIC DAMPER—Adapted to be located in an outlet flue pipe as a fuel saver, operating to gradually close as the draft diminishes preventing the escape of gas. Patent 1641875. J. Beaulieu, 351 Union Ave., Lynbrook, L. I., N. Y.

Machines and Mechanical Devices

SCREEN CLEANER—For screens through which spraying mixture of paint or like substance passes, whereby clogging of the screen is prevented by use of a special brush. Patent 1639590. L. O. Corkran, Chesterfield Farm, Rhodesdale, Md.

SHOE-SOLE DRIER—For use in the manufacture of shoes, directing heat to the shoe soles, without subjecting the uppers and entire shoe to the heat. Patent 1639592. L. H. Dastis, 3312 Clarendon Rd., Brooklyn, N. Y.

PLUG FOR OIL WELLS—Having a rubber element which when compressed will rigidly adhere to the wall of a well and prevent flow of water. Patent 1639079. W. C. Cushing, Box 113, Bristow, Okla.

WASHING MACHINE—Having means for forcing water into the clothes, and the cylinder divided in such manner that the weight of lifting the clothes is uniformly distributed. Patent 1639180. L. W. Hamilton, 215 Valentine St., Kenosha, Wis.

WIND MOTOR—Employing curved sails and shields to determine the extent of the sail area presented to the wind, and the area shielded. Patent 1640269. H. Ellison, 116 Wellington St., London, Ont., Canada.

TOBACCO DENICOTINING PROCESS AND APPARATUS—By which the nicotine can be easily and quickly extracted up to any percentage desired, the tobacco flavour and quality remaining fully preserved. Patent 1640298. J. Sartig, c/o G. Hirschfeld, Alexandrienstrasse, 134, Berlin, S. W. Germany.

SIGNALING MECHANISM—For use in conjunction with the elevator service in office buildings, for signaling the operator of a car the time to again start, after landing. Patent 1640286. R. A. Neuschotz, 545 W. 111th St., New York, N. Y.

AUTOMATIC LINE INDICATOR FOR TYPEWRITERS—Which requires no adjustment but is automatically operated when the lower edge of the sheet of paper comes to a pre-determined position on the platen. Patent 1640337. G. N. Alworth, 409 No. Chicago Ave., So. Milwaukee, Wis.

TROLLEY-WHEEL RETAINER—An attachment to a portion of the wheel fork arranged to form a guard around the trolley wire and thus keep the wheel in place. Patent 1640304. H. G. Winter, 119 Oakdene St., Pittsburgh, Pa.

GAS-CONTROL COCK—For controlling the flow from a main to a meter, any leakage around the cock, when in closed position, being vented to atmosphere, exteriorly of the building. Patent 1639431. H. B. Hutton, Jr., 423 West Harvard St., Glendale, Calif.

GOLF STROKE REGISTERING DEVICE—By means of which the distance which the golf ball would travel, were it not intercepted in its flight, is made visible by a series of lights indicating the number of yards the ball would have

traveled if struck on the open fairway. A novel mechanism returns the ball to the driver. The inventor has been granted two patents. 1639714 and 1639715. G. I. Thomson, 9041 Commercial Ave., Chicago, Ill.

PASTEURIZING APPARATUS—In which a traveling carrier conveys bottles of liquid through heating and chilling chambers, the heating and chilling being automatically operated as the bottles pass. Patent 1640289. S. Oymas, c/o H. Irwin, Box 806, Hilo, Territory of Hawaii.

SAFETY ATTACHMENT FOR WASHING MACHINES—Including means whereby the driving mechanism for the drum is rendered active or inactive by the locking or unlocking of the outer casing doors. Patent 1641080. J. E. Gariglio, 730 Henry St., Brooklyn, N. Y.

DOOR-OPERATING MEANS—Permitting of a person effecting an opening or closing of the doors, of a garage or other structure, at a point remote therefrom. Patent 1641067. C. A. Connelly, Marvin Ave., Shelby, Ohio.

METHOD OF AND APPARATUS FOR SETTING PIPE OR CASING AND PREVENTING SEEPAGE AND LEAKAGE IN WELLS—By means of a flexible liquid cement container, of tubular form, encircling the well casing at the point desired to effect cementation. Patent 1641035. G. A. Hero, 329 Schoupitoulas Ave., New Orleans, La.

VENDING MACHINE—For dispensing boxes of matches or other merchandise, constructed to provide a removal opening at the upper end, in a convenient position, thus eliminating a chute. Patent 1641860. E. Morell, c/o United Cigar Stores Co., 44 W. 18th St., New York, N. Y.

SHUTTLE-THROWING DEVICE—Wherein the shock of the loom will be readily taken up, and the rapid motion of the core checked at a desired time. Patent 1641882. C. C. Farwell, Groton, Mass.

EGG-MARKING DEVICE—A printing machine which will conform to curved surfaces, whereby delicate articles such as eggs may be safely printed or impressed with a suitable indicia. Patent 1641238. J. Schierenbeck, 136 Hudson St., Albany, N. Y.

TICKET-DISPENSING APPARATUS—For holding a multiplicity of tickets in a folded condition and in stack formation, the tickets being presented one at a time for removal. Patent 1641884. J. M. Fernandez, 231 E. 95th St., New York, N. Y.

ORE FEEDING APPARATUS—For automatically feeding ore to the rotating drum of an ore furnace, together with means for preventing over-feeding by temporarily rendering the mechanism inactive. Patent 1641863. W. H. Parsons, Middletown, Calif.

SPEED-REDUCING GEAR—Which may be readily adjusted to secure different speeds and transmit substantially any desired power through a belt or other transmitting means. Patents 1641845. T. L. Fitzpatrick, Massena, N. Y.

OIL-REFINING APPARATUS—A still composed of a plurality of horizontal preheaters for the cracking of heavier hydrocarbons and the production of the more volatile hydrocarbons, such as gasoline. Patent 1641852. H. A. W. Howcott, 320 Kernan Bldg., 317 Florida Ave., Baton Rouge, La.

VALVE—Adapted to open automatically when the pressure at the inlet reaches a predetermined pressure, which may vary at will within a considerable range. Patent 1641892. F. T. Lane, E. 3258 Pacific Ave., Spokane, Wash.

DEVICE FOR CEMENTING WELLS—Especially two-string wells, wherein the discharge of the cement is controlled by a float valve which co-acts with a seat arrangement in the well casing. Patent 1641915. A. Boynton, 1800 San Pedro Ave., San Antonio, Texas.

STEAM PRESSING APPARATUS—More particularly a small pressing apparatus for pressing articles which are long and relatively narrow width, such as hatbands, ties and like articles.

Patent 1641876. N. Benenati, c/o Munn, Anderson & Munn, 24 W. 40th St., New York, N. Y.

CEMENT PLUG—For closing the bottom of a well casing so that when the casing is lowered into liquid cement, the cement will be forced up on the outside. Patent 1641741. H. A. and C. F. Davis, c/o Cleo F. Davis, 108 North Broadway, Redondo, Calif.

Medical and Surgical Devices

DIATHERMY KNIFE—A combination of an electrode and a detachable blade, by which the destruction of tissue and the removal thereof can be effected simultaneously, without bleeding. Patent 1639996. S. H. Groff, 1160 Magnolia Ave., Long Beach, Calif.

TRUSS—Having a novel bearing member for exerting pressure on the pad, as well as novel means for adjusting the pad position. Patent 1641339. D. O'Brien, Punta, San Juan, Cuba.

Prime Movers and Their Accessories

INTERNAL-COMBUSTION ENGINE APPLIANCE—Which may be readily attached to any stationary or automotive engine of common use, for pre-heating, cleaning, moistening and mixing the air, to full capacity or varied degrees. Patent 1641052. L. Rogers, Carson City, Nevada.

ROTARY ENGINE—In which valves and valve-operating means, crank shafts and connecting rods, are dispensed with, thereby eliminating faulty operations, and reducing vibration to a minimum. Patent 1641911. T. Tschudi, c/o Chevenet Equipment Co., P. O. Box 1333, Paterson, N. J.

Pertaining to Recreation

WATER-SPORT APPARATUS—Which is buoyant to sustain a person afloat assuming a sitting posture, while permitting the use of the legs to propel the apparatus. Patent 1639607. B. L. Henry, c/o E. A. Gainzburg, 302 5th Ave., New York, N. Y.

AMUSEMENT DEVICE—Including a moving frangible target supporting a prize, said target when broken by a projectile, releasing the prize for delivery to a participant. Patent 1639596. A. M. Dritz, 258 5th Ave., New York, N. Y.

JUMPING DEVICE—An elliptical spring device, worn in the manner of a skate, whereby a child is able to jump relatively to great heights and distances. Patent 1638350. G. H. Long, 17 Dundas Drive, Lankershim, Calif.

GOLF-GAME APPARATUS—Employing a checker board embodying features characteristic of golf, certain squares being trapped with bunkers, sand-pits, water hazards, and out-of-bounds simulating a golf course. Patent 1640699. W. Gaston, 160 W. 231 St., New York, N. Y.

CHECKERBOARD—Having novel checker holding means incorporated therewith in such manner that the foldable sections when in folded position house the checkers and prevent loss. Patent 1641104. W. P. Solod, c/o Henry Siegel, 1779 81st St., Brooklyn, N. Y.

Railways and their Accessories

SIGNAL—For displaying a warning at a railroad crossing, which is automatically positioned by the train approaching the crossing and rendered inoperative after the train has passed. Patent 1641855. J. L. Lamont, c/o Jos. L. Shaw, Atty., Geneseo, Ill.

Pertaining to Vehicles

STEERING DEVICE FOR MOTOR VEHICLES—Consisting of a large toothed ring entirely con-

tained in the vehicle body, and through which the driver's legs may be inserted, said ring engaging a pinion which controls the steering shaft. Patent 1638750. C. Schaeffer, c/o C. Bietry, Boulevard de Strasbourg, Paris, France.

HYDRAULIC SHOCK ABSORBER FOR MOTOR VEHICLES—Comprising a circular drum, and a spindle mounted to project from the center and oscillate therein, may be applied to front or rear axles and springs. Patent 1638777. W. P. Mason, c/o Collison & Co., 483 Collins St., Melbourne, Australia.

AUTOMOBILE LOCK—Especially designed for use on hand brakes to secure the latch rod, and consequently prevent movement of the car by unauthorized persons. Patent 1638688. W. F. Fipps, 3152A So. Compton Ave., St. Louis, Mo.

POWER ATTACHMENT FOR MOWERS—Whereby a mowing machine may be operatively connected with a Ford automobile, so that the parts will function to produce a forward mowing. Patent 1638680. J. A. Cook, P. O. Box 83, Franklin Furnace, N. J.

HEADLIGHT ATTACHMENT—For use on ordinary automobile headlights for preventing the blinding rays thrown in the eyes of approaching drivers, but without dimming the light on the road. Patent 1639600. C. B. Frierson, Box 668, Cleveland, Miss.

DEVICE FOR ALIGNING WHEELS—To be employed in connection with the front wheels of an automobile for disclosing the amount of correction necessary, if the wheels are out of alignment. Patent 1639604. J. H. Gray, 9th and Felix Sts., St. Joseph, Mo.

LOCKING DEVICE FOR MOTOR CONTROLS—For rendering motor control parts, such as the spark and throttle levers, unmovable, especially adapted for use with the steering assemblage of a Ford automobile. Patent 1639612. J. F. Nevius, 957 Caldwell Ave., Bronx, N. Y.

COUPLING—Adapted for use as a connector for a strap or the like with a chain or the like of a draft appliance for a vehicle. Patent 1639609. C. Hoffland, Westhope, N. D.

SAFETY APPARATUS FOR VEHICLES—Operable in response to force applied to the bumper by contact with a person, whereby the emergency brake mechanism stops progress, and a guard is simultaneously released. Patent 1640336. J. E. Jufe, 519 W. 189th St., New York, N. Y.

AUTOMATIC STEVEDORE-TRUCK BRAKE—Which will ease the load on an incline, and function to automatically stop the truck, to prevent it running over or injuring the workman, should he fall. Patent 1640308. A. J. Becker, 573 Park St., Upper Montclair, N. J.

WHEEL OR TIRE HANDLING APPARATUS—Which may be conveniently attached to any ordinary mechanical or hydraulic jack, and easily manipulated for the mounting or demounting of wheels or tires. Patent 1640297. F. Rogers, c/o Credit Lyonnais, Paris, France.

VEHICLE LAMP—An arrangement for mounting a pair of headlights on a vehicle and connecting them so that they may be turned simultaneously about a parallel or aligned axis. Patent 164041. J. H. McPherson, 217 Ruben Bldg., McKeesport, Pa.

MIXTURE FOR STOPPING LEAKS—May be poured into automobile radiators and will act quickly for sealing a leak, the composition consists of water, sugar, flaxseed and salt. Patent 1641066. J. D. Campano, Berkeley Heights, N. J.

TRAILER COUPLING—Wherein means are provided for connecting the engine of the tractor to the coupling mechanism for raising the trailer, when it is desired to uncouple the same. Patent 16731. (Reissue). W. Mayer, 47 Gowne St., Forest Hills, L. I., N. Y.

BRAKE—More particularly a brake for the front or steering wheels of automobiles, either when parallel to the longitudinal axis or turned at an angle. Patent 1641912. G. Walker, 1409 16th St., Huntington, W. Va.

INDEX TO ADVERTISERS

SCIENTIFIC AMERICAN—DECEMBER, 1927

American Lead Pencil Co.	552	Metal Cast Products Company.	560
American Pipe Bending Machine Co.	560	Metallic Sign Letter Co.	560
American Telephone & Telegraph Co.	550	William Moge & Sons, Inc.	560
American Tobacco Company.	Fourth Cover	Moore & Company.	559
		Munn & Company.	564-573
Francis Bannerman Sons.	552	National Carbon Company.	547
Bernard & Heller.	560	Norton Company.	549
Broderick & Bascom Rope Co.	551	Packard Motor Car Company.	Third Cover
Chicago Stock Gear Works.	560	Pathfinder Publishing Company.	560
H. L. Cook.	560	Portland Manufacturing Company.	554
Cortez Cigar Co.	559	Riverbank Laboratories.	550
Crosman Arms Company.	559	Royal Typewriter Company.	Second Cover
Dayton Steel Foundry Company.	557	William A. Schaerr.	560
Dr. C. Deedera.	557	Schwerdtle Stamp Company.	552
F. J. Drake & Co.	552	Simonds Saw & Steel Company.	552
Ethyl Gasoline Corporation.	555	SKF Industries, Inc.	481
The Farrington Company.	565	Stephenson Laboratory.	560
Firestone Tire & Rubber Company.	559	Technical Products Company.	552
Florsheim Shoe Company.	563	Time, Inc.	567
Forbes Magazine.	562	Timken Roller Bearing Company.	484
Forhan Company.	560	Unisol Manufacturing Company.	550
General Electric Company.	576	United Electric Motor Co.	560
Golden Book Magazine.	566	U. S. Tobacco Company.	553
Hoffman Specialty Company.	558	Veeder Manufacturing Company.	564
International Correspondence Schools.	557	Vilter Manufacturing Company.	552
International Harvester Company.	545	J. D. Wallace & Co.	560
International Typewriter Exchange.	550	L. E. Waterman Company.	Color Insert
Laboratory Materials Company.	559	Williams & Wilkins Co.	561
Liggett & Myers Tobacco Company.	561	Winchester Mfg. Company.	560
Lionel Corporation.	482	Wisconsin Electric Company.	556
Los Angeles Chamber of Commerce.	486	Henry Zhur.	557

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INDEX TO VOLUME 137—JULY-DECEMBER, 1927

Lack of space makes it impossible to give many cross-references or to enter a given reference in more than one place. Each article is therefore entered where it is believed it will be most easily found. In every case, the general subject should be sought rather than the supposed specific title of an article. We call special attention to the classifications "Aviation," "Radio," etc., under which many items will be found whose location otherwise would be very puzzling. The asterisk (*) indicates that the article in question is illustrated.

A		ELECTRICITY	
AGRICULTURE		Atomic hydrogen welding.....	*350
Artificial ripening of fruits.....	74	Bell, Welding crack in.....	*323
Blueberry cleaner.....	*64	Berliner, transmitter.....	*34
Boll weevil control.....	*165	Bulbs, inside frosted.....	266
Cave, Man-made.....	*303	Corn popper, Electric.....	*343
Ellis Island, Agricultural.....	*48	Diesel-electric locomotive.....	*64
Ethylene a ripener?.....	542	Electric baker.....	*157
Selenious acid as weed killer.....	84	Electrical theory of muscular action.....	*396
Sulfite liquor for spray.....	*174	Electric timing apparatus.....	*124
Trap for crows.....	*85	Electric truck.....	*252
Water—the modern Aladdin.....	*510	Floodlight projector used to recover body.....	*442
Wheat smut, Controlling.....	*264	Franklin rods.....	*554
ANTHROPOLOGY AND ARCHAEOLOGY		General Electric Laboratory.....	*318
American farmers of 4000 B.C.....	*22	Iron, electric, Safeguarding.....	*343
Ancient Man, New Trails of.....	*114	Langmuir's exhaust pump.....	*273
Anti-evolution legislators.....	254	Lightning protector.....	*489
Brains of prehistoric men.....	*216	Photo electric cells.....	*319, *380
Dawn—Man or Ape.....	*230	Piano instruction by electricity.....	*323
Egyptian miracles.....	*529	Power plant 1,000,000 Kw.....	*216
Everglades conquered?.....	*134	Protecting battery terminals.....	174
Head hunters of Burma.....	*393	Searchlight, Largest.....	*437
Muscles built the pyramids.....	*396	Sky painting—Light gun.....	*143
Mummies, Research on.....	*219	Storage battery, Electrolyte.....	264
Southwestern aborigines.....	*22	X-Raying for liquor.....	*155
Sphinx, Renovated.....	*67	Talking sign.....	*401
Troglodytes of the Desert.....	*297	Testing automobile horse-power.....	*330
ASTRONOMY		Windmill power.....	*268
Astronomy, Complete.....	365	F	
Cipher in message of the Stars.....	*118	FISH AND FISHERIES	
Comets, photographing.....	*341	Fish elevator.....	*137
Four sunless worlds.....	*312	Floating factories.....	441
Heavens month by month.....	*90, *176, *274, *362, *475, *558	Oysters, Growing, on trees.....	*156
Home made telescopes.....	*87, *281, *377, *468, *554	Turtle trap.....	*179
How do they know?.....	*402	FOODS	
Mars, Is it habitable.....	*20	Sandblasting eggs.....	*364
Odd stars.....	*208	FORESTRY	
Solar eclipse in England.....	*214	Redwood.....	160
Stars of the Manger.....	*25	Stump removal.....	*348
Sunburn in the dark.....	*25	Tree swallows tree.....	185
Telescope makers convene.....	*345	FUELS	
Telescope mirrors, making.....	*184	Fluid fuel from coal.....	*65
ATHLETICS		Oil well fumes for fuel.....	*343
See SPORTS		Oil well, Wanderings of.....	*46, 206
AUTOMOBILES		Powdered coal challenges Diesel engines.....	348
Amphibious Ford.....	*155	Pulverized coal for marine boilers.....	*341
Auto homicide equipment.....	*163	G	
"Electric scooter".....	*111	GASES	
Novelties in Automotive Transportation.....	*111	Noble gases, uses of.....	*408
400,000,000 horse-power.....	*330	GEMS AND PRECIOUS STONES	
Front end drive.....	*62	Mikimoto and the culture pearl.....	*300
Lumber truck.....	*439	GEOLOGY	
Motor-bus, luxurious.....	*399	Cave, Man-made.....	*303
Motor caravan.....	*215	Geological summer school.....	68
Motorcycle de luxe.....	*111	Meteor crater.....	*52, *244
Oil transport in Germany.....	*442	Most fascinating spot.....	*144
Parking, Aids to.....	*62	Oil Well, Wanderings of an.....	*46
Road map.....	*344	H	
Roadster, Truck.....	*62	HEREDITY	
Tire life, Measuring.....	*350	Hereditascope.....	*443
Truck unloads itself.....	*441	HOUSEHOLD	
Trunk for automobiles.....	*344	Aids to the household.....	*534
Valve and piston ring tools.....	*439	Baking pan.....	*157
Wool-piling truck.....	*344	Cabinet table.....	*157
AVIATION		Can opener.....	*60
Air cooled engines.....	*148	Coffee strainer.....	*63
Atlantic, Shall we fly?.....	*112	Clothes cleaner.....	*61
Bellanca's transatlantic preparation.....	*72	Cork screws.....	*61
Byrd and the "America".....	*256	Dish washer.....	*60
Destroying for safety.....	*445	Fire fighter.....	*60
European aviation impressions.....	304	Household inventions.....	*60, *157, *253, *343, *440, *534
German transatlantic liners.....	*444	Iceless refrigerators.....	*253
Glider, model.....	73, 472	Iron, Safeguarding the.....	*343
Helicopter.....	*86	Keeping food hot.....	*61
High Altitude equipment.....	*206	Kitchenette.....	*60
Honolulu flight.....	*258	Knife polishers.....	*252
"Learning to Use our Wings.....	*539	Pen knife.....	*60
Life saving aeroplane.....	*497	Pouring ladle.....	*61
Lindbergh's flight.....	*167	Spoon polisher.....	*61
Model aircraft.....	*448, *543, *544	Tape measure.....	*61
Motor and the man.....	*112	Typewriter table.....	*344
Parachute jumpers.....	*392	HYDRAULICS	
Propeller design.....	*89	Primitive Irrigation Methods.....	28
Radio aid to aircraft pilots.....	*305	I	
Safe aircraft competition.....	360	INDUSTRY	
Ship to shore.....	*352	INVENTIONS	
B		INDIAN	
BALLOONS		INSTRUMENTS	
Cross country jumping.....	*39	INSTRUMENTS	
BIOGRAPHY. See also INVENTORS		INSTRUMENTS	
Chamberlain, Dr. T. C.....	*199	INSTRUMENTS	
Coolidge, Dr., Portrait of.....	*318	INSTRUMENTS	
C		INSTRUMENTS	
CANALS		INSTRUMENTS	
Uncle Sam Spendthrift.....	*55	INSTRUMENTS	
CHEMISTRY		INSTRUMENTS	
Acetone and butanol.....	*30	INSTRUMENTS	
Ammonia oxidation unit.....	*542	INSTRUMENTS	
Ammonia, Synthetic.....	*446	INSTRUMENTS	
Atomic hydrogen, Flames of.....	*350	INSTRUMENTS	
Corrosion of metals.....	*262	INSTRUMENTS	
Drug manufacture.....	541	INSTRUMENTS	
Dry ice.....	*2	INSTRUMENTS	
Fumigant non-burnable.....	542	INSTRUMENTS	
Glaucon.....	76	INSTRUMENTS	
Industries from atoms.....	*165, *262, *350, *446, *541	INSTRUMENTS	
Lacquer films.....	370	INSTRUMENTS	
Mercury vapor, Detecting.....	*255	INSTRUMENTS	
Metal cleaner.....	*541	INSTRUMENTS	
Methanol, Synthetic.....	542	INSTRUMENTS	
Microbe in International affairs.....	*30	INSTRUMENTS	
Naptha re-refining dry cleaners.....	*460	INSTRUMENTS	
New lights for old.....	*430	INSTRUMENTS	
Plaster of Paris molds, Re-use of.....	275	INSTRUMENTS	
Synthetic clothing.....	541	INSTRUMENTS	
Tear gas as a fumigant.....	262	INSTRUMENTS	
Transmutation foils.....	163	INSTRUMENTS	
World of chemistry.....	74	INSTRUMENTS	
X-ray studies of lime.....	*541	INSTRUMENTS	
CITY PLANNING		INSTRUMENTS	
City of the Future.....	*238, *334	INSTRUMENTS	
COMMERCIAL PROPERTY NEWS		INSTRUMENTS	
Commercial Property.....	*92, *188, *285, *379, *477, 569	INSTRUMENTS	
Exaggeration in trademarks.....	*92	INSTRUMENTS	
Factory-to-you slogan.....	286	INSTRUMENTS	
Katz underwear.....	189	INSTRUMENTS	
COPYRIGHTS		INSTRUMENTS	
New Copyright law.....	*188	INSTRUMENTS	
D		INSTRUMENTS	
DAMS		INSTRUMENTS	
World's largest artificial lake.....	*237	INSTRUMENTS	
E		INSTRUMENTS	
EDITOR'S MAIL		INSTRUMENTS	
.....	*86, *184, 279, *372, *468, *554	INSTRUMENTS	
EDUCATION		INSTRUMENTS	
Chemistry teaching in West.....	*372	INSTRUMENTS	
Learning language by its feel.....	*522	INSTRUMENTS	
Socially intelligent.....	*108	INSTRUMENTS	
ENGINEERING		INSTRUMENTS	
Airport building with dredges.....	*223	INSTRUMENTS	
America's largest tunnel.....	*40	INSTRUMENTS	
Casting, Huge.....	*254	INSTRUMENTS	
Culvert "Gopher".....	*161	INSTRUMENTS	
Ditch and post-hole digger.....	*63	INSTRUMENTS	
Hudson Tunnel.....	*200	INSTRUMENTS	
Mississippi, Modernizing.....	*536	INSTRUMENTS	
Painting mile long cable.....	*113	INSTRUMENTS	
Panama Canal.....	400	INSTRUMENTS	
Pipe carrier.....	*63	INSTRUMENTS	
Pipes, large, moving.....	*63	INSTRUMENTS	

INDIANS

Seminole Indians.....*134

INVENTIONS, NEW AND INTERESTING

*60, *157, *252, *343, *438, *532

INVENTORS, SUCCESSFUL

Berliner.....*33
 Jenkins, C. Francis.....*140
 Lockhart and Hawk's tape dispenser.....*242
 Hazeltine, Louis A.....*328
 Deubener's bag and string.....*414
 Knight.....*513

IRRIGATION. See also AGRICULTURE

Primitive Irrigation Methods.....*28

M

MEDICINE

Acidosis.....428
 Bandage cutter.....252
 Blood cells, Number of.....428
 Boric-acid poisoning.....138
 Children, Physical defects of.....218
 Children's clothing, Change.....139
 Circulation testing.....429
 Heat stroke.....314
 Hookworm, Diet for.....552
 Kahn and Wassermann test.....429
 Longevity.....137
 Loose joints.....*138
 Lung collapsed.....*139
 Milk from stall fed cows.....219
 "Magic Horse Collar".....314
 Month in medical science.....*18, *138, *218, *314, *428, *520
 Poison ivy conquered.....162
 Skin eruption from linseed oil.....219
 Sleepy sickness.....*224
 Snake venom, Extracting.....*233
 Spectacles for horses.....*538
 Sunburn in the dark.....*25
 Sunlight treatment.....*315
 Synthalin in diabetes.....18
 Thumb suckers.....429
 Trachoma.....429
 Treatment timer.....*19
 Tumor of fat.....*19
 Ultra-violet light.....*138
 Water treatments in disease.....*428

MERCHANT MARINE

"Ile de France".....*342
 Life boats made safer.....*427
 Merchant marine and the Navy.....400
 Safety at sea.....*407

METEOROLOGY

Freak of storm.....*88
 Storms and tornadoes.....*105
 Tornadoes.....*105
 "Twister".....*104
 Weather map receiving apparatus.....*142

METALLURGY

Alloy "Stellite".....*163
 Casting, Huge.....*254
 Modern foundry arrives.....*519
 Silver solder.....174
 Vanadium.....270

METEORS

Buried.....*144

MICROSCOPY

Light Screen.....*354
 Photomicrography.....*78
 Telescope and microscope.....*438

MINING

Prospecting by radio.....356

MOTION PICTURES

Camera as aid to naturalist.....*152
 Jungle life, Recording.....*127
 Motion picture camera of 1895.....*141
 Movie theatre up to date.....*516
 Roxy theatre.....*516
 Sounds recorded on "movie" film.....*234

MUSIC

Piano instruction by electricity.....*333
 Piano rolls.....*423

N

NATURAL HISTORY

Conservation or extinction?.....*416
 Firefly lights.....*316
 Insects, Do they feel pain?.....*531
 Jungle life, Recording.....*127
 Mosquitoes, Bad news for.....284

Snake venom extracting.....*233
 Woman's adventures in Africa.....*325

NAVAL MATTERS

Battleships.....*526
 Naval Conference disarmed.....304
 Navy Day.....400
 Naval limitation.....*206
 "Old Ironsides" in dry dock.....*530
 Submarine, First.....*437

ORDNANCE

Super-guns for our Army.....*8-13

O

OPTICS

A simple study in optics.....*421

P

PATENTS

Bouillion cubes, Patented.....93
 Cooperation among inventors.....379
 Delays are Fatal.....*188, 380
 Equivalents, Law of.....285
 Exaggeration is excusable.....92
 Functions cannot be patented.....478
 Inventions for Uncle Sam.....380
 Law protects secret process.....285
 Old claims in new applications.....92
 Premature publicity.....286
 Recently issued patents.....92, 188, 285, 379, 477, 569
 Stillson wrench case.....477

PEARLS

.....*300

PHOTOGRAPHY

Cellulose films.....367
 Invisible rays, Photographing by.....*155
 New lights for old.....*430
 Perspective photography.....82

PHYSICS

Cold light.....*316
 Earth, Watching the, Turn.....*14
 Molecule, On the trail of the.....*309, *433
 Noble gases, use of.....*408
 Optics, Simple study of.....*421
 Pendulum experiments.....*14
 Pendulum, Foucault's.....*14
 Speech, Invention of human.....*204
 Stupendous pressures.....*43
 Ultra-violet radiometer.....*25
 Workshop of scientists.....*318

PHYSIOLOGY

Evolution of the human eye.....*404
 Learning language by its feel.....*522

PSYCHIC MATTERS

Telepathic mind, specimens from.....*210

PSYCHOLOGY

Police brain power.....163
 Socially intelligent?.....*108

R

RADIO

Batteries and eliminators.....70
 Condenser, New.....171
 Freight trains, Radio for.....*358
 Giant of broadcasting.....*500
 Ideographs by radio.....*141
 KDKA transmission system.....*320
 Loop antenna.....*71
 Marconi beam dodges sunlight.....*329
 Neutrodyne, First.....170
 Old instruments returning.....*272
 Pictures enlarged when received.....172
 Programmes in Braille.....*356
 Prospecting by radio.....*170
 Power transmission.....*305
 Radio aid to aircraft pilots.....*132
 Radio's goliath.....172
 Radio engineering.....*69, *170, *260, *356
 Radio notes.....*320
 Radio pioneer steps forward.....*356
 Socket-power units.....*450, *546
 Strays from the ether.....*178
 Tagging cables.....71, *72, 260
 Tubes.....69
 U. S. leads.....*424
 What is new in radio?.....*226
 Why fly without radio?.....*450
 WEAFA modernized.....*36
 When the President broadcasts.....*226
 Why fly without radio.....*226

RAILWAYS

Diesel-electric locomotive.....*64
 Every man's locomotive.....*123

Locomotive water-tube.....*437
 Water-tube boiler locomotive.....*437

REFRIGERATION

Cheaper mechanical refrigeration.....542
 Ice that melts to a gas.....*220

RUBBER

American possibilities in growing rubber.....462

S

SAFETY

Carbon monoxide.....74
 Fires, Fighting unseen.....*536
 Life boats made safer.....*427
 Reducing hazard point removers.....277
 Safety at sea.....*407
 Safety strap.....*72, *252

SANITARY SCIENCE

Garbage disposal.....*166
 Save the water.....206

SCIENCE

Applied Science for Amateurs.....*78, *174, *264, *354, *448, *543
 New science and new religion.....160
 Polarized light affects life.....346
 Research underlies prosperity.....551
 Scrap-Book of Science.....*58, *154, *250, *340, *436, *508

SCIENTIFIC AMERICAN DIGEST

*64, *160, *254, *345, *441, *535

SPORTS

Are athletes machines?.....*124
 Balloons, Cross-country jumping.....*39
 Bathing suit, safe.....*159
 Floater, Florida.....*174
 Golf.....*522
 Golf ball cleaner.....*158
 Golf club, adjustable.....*120
 Golf clubs, Scientific.....*159
 Life saving belt.....*247
 Rowing speed.....*159
 Sport umbrella.....*159

STEAM ENGINEERING

Mercury-vapor plant, Emmet.....*254

T

TECHNOLOGY

Bell, Repairing.....*323
 Color matching machine.....*155
 Stone like cast-iron.....*130

TOOLS

Automobile tools.....*439
 Cotter keys.....*354
 Counterbalance weight.....*83
 Lock nut.....*179
 Nibbling sheet metal.....*252
 Rule, useful.....*438
 Solder holder.....*473
 Tool racks.....*252
 Wheelbarrow.....*252

TRADEMARKS

Grade marks and trademarks.....189
 Iron age of trademarks.....286

TRAVEL AND EXPLORATION

Africa, Impressions of.....*324
 Head hunters of Burma.....*393
 Martin Johnson in Africa.....*152
 Troglodytes of the Desert.....*297

TUNNELS

America's Largest.....*40
 Hudson Tunnel.....*201
 Moffat Tunnel.....*338

U

UNCLE SAM SPENDTHRIFT

Lake and river systems undeveloped.....*55

W

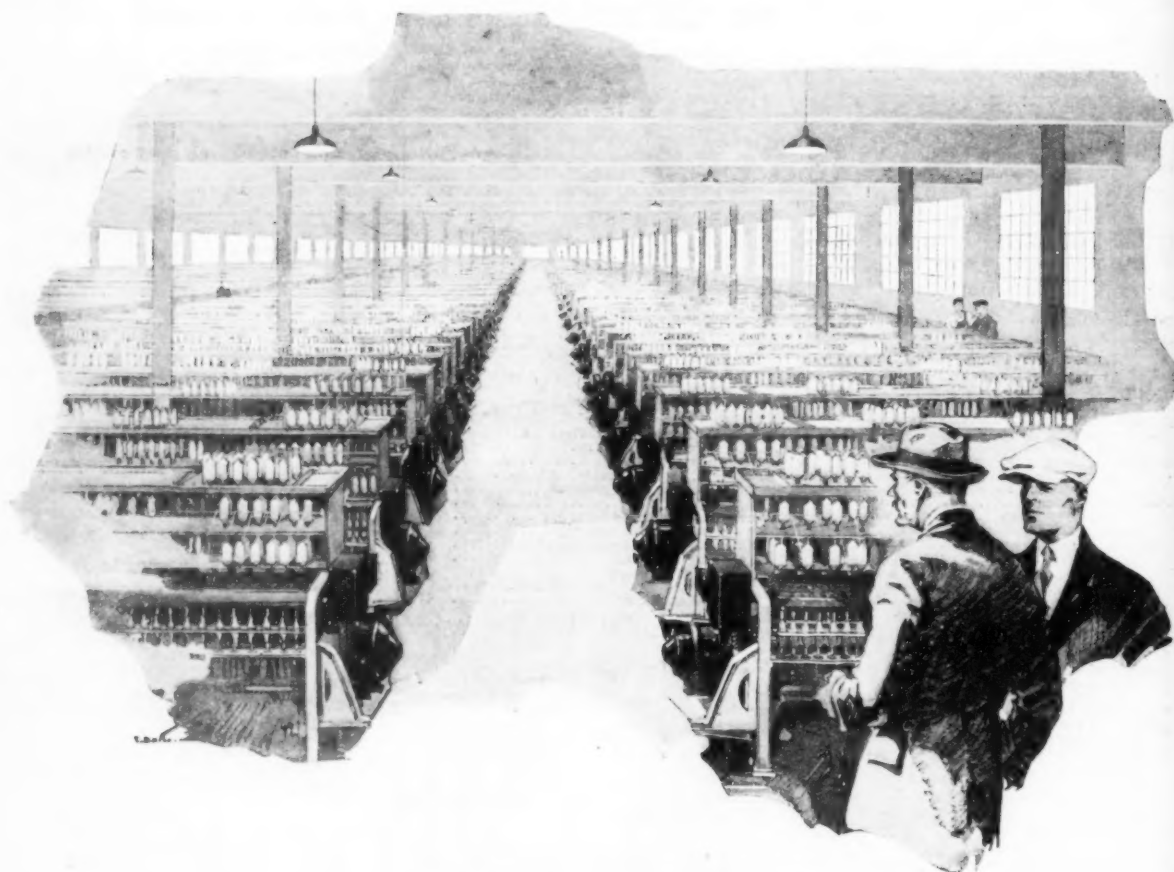
WARFARE

Great Britain's mechanised army.....*503
 Smoke screen.....*439

Y

YACHTING

Sloop versus schooner.....*229



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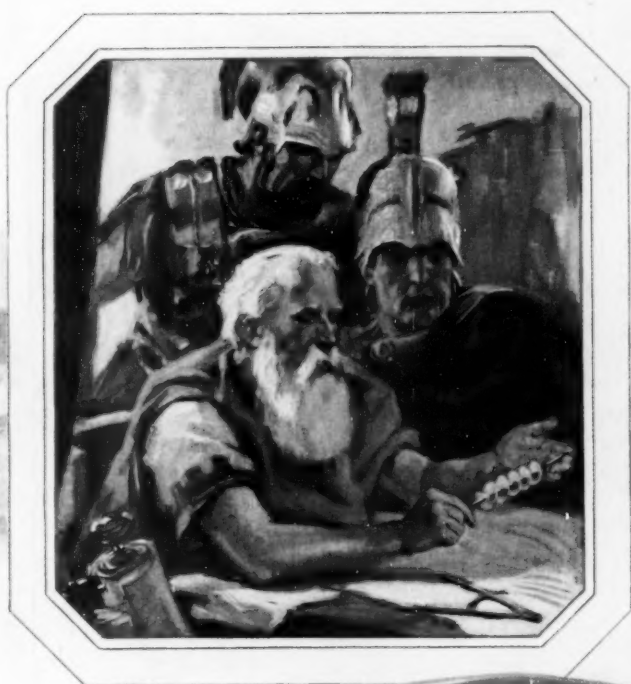
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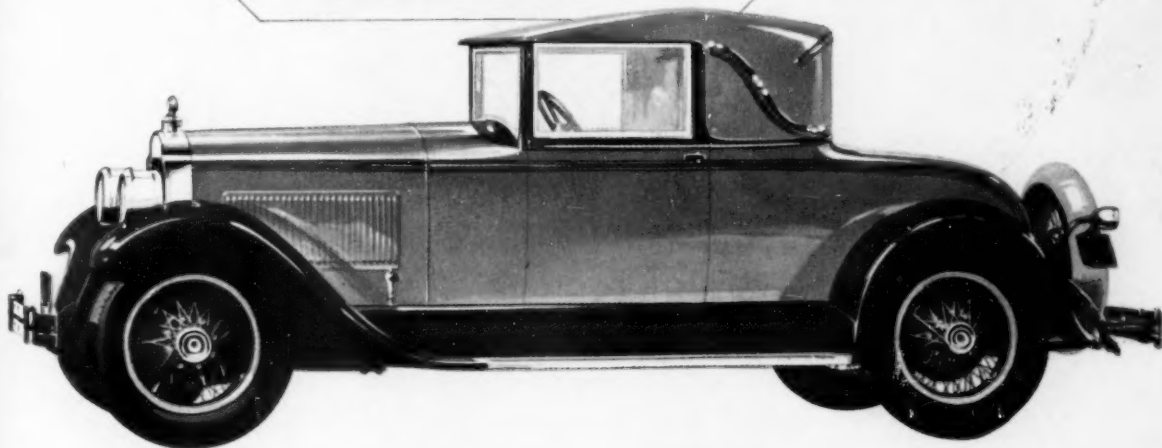


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David Belasco.



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